American Machinist

March 24, 1937

German Tools—John Haydock, managing editor, visited the machine tool exhibition at this year's Spring Fair at Leipzig. See page 270a for descriptions and photographs of new German equipment.

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KENNETH H. CONDIT *and* FRED H. COLVIN
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The Solution Of Today's Most Pressing Problem— How To Raise Wages, For Everybody!

We would commend to every reader the articles on pages 239 and 240 of this issue. One of them tells how the mammoth Ford Motor Company has benefited by its policy of persistent and continuous modernization of equipment. The other pictures the advantages of a similar policy to a relatively small shop.

And note that these benefits are shared by everybody,— by labor, by management and ownership, by the customers.

The wages of labor may be properly raised whenever the worker is given more productive tools. For he is then creating a greater real value. He can be compensated in proportion to what he creates.

The wages of ownership, of stockholders, of management, are also raised when lower-cost equipment is installed. For then the value of product, in relation to its manufacturing cost, is increased. And greater profit margins result.

The wages of the customer, too, are raised. For he can be given a bigger value. His dollar buys more.

Again let us say it. We commend these policies of persistent and continuous installation of modern equipment, as the solution of today's most pressing problem.

AMERICAN MACHINIST

Talking Shop

Scrapping $175,000,000

The American workman is the highest priced workman in the world because American management has furnished him with the best working equipment in the world. The American workman earns more money, owns more property, uses more goods and is able to save more by his thrift than any other, not because he works harder or works longer hours—he is very far from doing either of these—but because his better equipment under expert direction enables him to produce more. In ordinary work no other method can command a high price. The very best of workmen could not do it without the best equipment and the best possible organization of work. You have merely to look where the best tools and best methods are *not* used to find where good wages are *not* paid.

Of course, to equip people to earn good wages costs a lot of money; that is why it is not done everywhere. Money-minded managers find it too expensive. Progressive managers discovered long ago that it is cheap labor that costs most, and expensively equipped and highly paid labor is in every way the most economical to employ.

At the present stage of industrial development, we have definitely passed the point where men can earn more simply by working longer and harder. Improvement does not come that way these days; it comes solely by enhancing individual usefulness through modern tools and efficient management of work.

In the last eight years (seven of which were deep depression years) the Ford Motor Company scrapped 46 per cent of its entire plant. The actual value involved was $175,000,000. And most of the objects scrapped were in excellent condition, measuring up to the standards by which, at that very time, the Ford Motor Company was ranked as being the most modern manufacturing plant in the world. A concern mainly intent on money could have kept that equipment in service for years to come. Many antiquated manufactories exist whose out-of-date machinery and methods are a heavy charge on the public year in and year out. The equipment scrapped by the Ford Motor Company was not worn out or broken, nor obsolete in the ordinary sense. The power plant, $20,000,000 worth of which was scrapped, was as good as the day it was built—maybe better, but a more economical system of making power had arrived, and if the Company was to give to its product and to its customers and to its employes the benefit that comes only from using the most improved methods, there was just one thing to do. In the Ford Motor Company a thing is obsolete, no matter how good it is, as soon as its better appears.

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Because he has expressed so concisely the philosophy of the modern shop, we are turning over the Talking Shop page this time to W. J. Cameron of the Ford Motor Company. We commend this Ford Sunday Evening Hour talk of his to shop owners and managers everywhere, and to the men down the line.—*The Editors.*

•

Now, this $175,000,000 worth of scrapped equipment was replaced during the same eight years with $217,000,000 of new equipment—which averages an expenditure of 2¼ million dollars a month for the 96 months. People of no business experience and obsessed by an exaggerated notion of the dollar—that is, money-minded people—would declare this a grievous waste. It was not waste—it was economy—it was a great saving. Had the Company been money-minded and "saved" that $217,000,000 by replacing little or nothing new during the last eight years, the public would literally have lost that $217,000,000 by being deprived of the values which that sum should have brought into existence. By the public, we mean everyone who has any connection with the Company, everyone who sells it materials, everyone who buys its product, everyone who works for it.

When that $175,000,000 of scrapped equipment was replaced by $217,000,000 worth of new installations, both these sums necessarily found their way into American industry and provided work and wages for men other than our own—from miners to machine tool builders. What it did for our own men was this: it gave them a blanket wage increase of a dollar a day during two years of the depression; they were the last in large industry to feel unemployment or wage-cuts; they were the first in large industry to come back to the full minimum wage rate; it secured for them last year 100,000 individual wage increases which amounted to about $141 a man; and it increased last year's payroll by $45,000,000.

This is the vital connection that exists between management and employment. You can't have one without the other. But in spending money there is this difference: every dollar spent even by mismanaged industry, goes for wages somewhere, because all industrial payments are reduced to wages at last; but the dollar spent by a wisely managed industry, spent to acquire better methods and machines, spent to make better things in a better way, does something more than merely maintain present values and wages, *it creates higher values for customer and higher wages for worker.* And it is the only method that can.

A Small Shop

Replaces Equipment Every Seven Years
Pays Weekly Salaries to Its Men
Operates Consistently at a Profit

K. H. CONDIT
Editor

THIS is the story of a small shop that has made money ever since it started, that replaces all of its equipment every seven years, and that pays its men on a weekly salary basis. The success of its management in accomplishing these decidedly unusual ends should be an incentive to every manager of a metal-working plant large or small which has not as yet attained these objectives.

Equipment selection and operation is based on the theory that if the machine equipment is right and the operators are satisfied with their pay and working conditions the work coming from those machines will be right. This company, the R. G. Haskins Company of Chicago, has been operating in its present location for fourteen years. During that time every machine in the plant except one has been replaced twice. In other words, the maximum age of the present equipment is seven years with the exception of one nine-year old machine which is due to be replaced shortly.

An interesting result of this policy has been that production has been increased fourfold with the addition of only three men during the fourteen years in the present building. Workmanship is to unusually precise limits, aluminum housings for the machine spindle going together with a snap fit that makes it possible to pick up the whole string of four units by the top unit without separation at any joint. There are no inspectors in the plant, each man taking full responsibility for the quality of his workmanship.

Machine tools that have been disposed of after the established seven-year life have brought on the average 46 per cent of the original cost in second-hand value. Some machines have brought more than this amount, others a trifle less. Replacements were continued throughout the depression in order to maintain the maximum age limit established as desirable for this class of work.

The plant is operating today with practically the same number of machine tools it had when it started. The great increase in production has been accomplished by replacing existing units with new ones of greater capacity rather than to duplicate units when a particular one reached its capacity. It has taken a good deal of study in some cases to discover a machine that had the necessary additional capacity, but in each case this has been done. Mr. Goldberg, the works manager, remarks that his faith in the machine tool industry's capacity to produce more and more productive machine tools has been put to the test on more than one occasion, but so far has always been vindicated. At the moment no one of the machines in the shop is being operated to capacity.

Machines are rearranged periodically as replacements are made and as changes in production requirements demand. Output has increased fourfold in 14 years

In this plant 95 per cent of the product is manufactured and the balance is purchased outside. Castings are purchased and plating and japanning operations are contracted

out. In purchasing tools three duplicate sets are ordered to make sure that production will never be delayed by tool failure. The result of this policy has been, of course, that occasionally the third set has had to be scrapped before it was ever used, but the management feels that this policy provides a worth while form of insurance. Very few tools are made in the plant itself because it is considered better business to buy them from experts in tool manufacture. For machines with built-in belt drives of any type a complete new belt unit is always available in case of failure.

All machines have individual motor drive which makes it possible to rearrange all of the equipment periodically when circumstances demand it. With the exception of the machines in the tool room the machine tool equipment is in practically constant operation. All machines are painted an olive green color which was selected after some experimenting to find out the best color to prevent the disfiguring effects of oil spots, and every machine is repainted twice yearly.

Orders Filled Promptly

About half of the orders received are shipped from stock within one day after receipt and 90 per cent not later than the second day after the order is received. Repair parts are given precedence and usually go out on the same day. They are never shipped later than the day after the receipt of the requisition.

In making purchases of equipment, tools or materials it has been the policy of the company to depend on the reputation of the supplier rather than to ask for competitive quotations on the theory that that is the best way to get a quality article. The management has never been imposed on by suppliers so far as it knows. It has been found decidedly economical to pay a somewhat higher price than the minimum for castings in order to save scrapping of parts after some machine work has been done on them. One particular lot which cost 16¢ per lb. turned out to be the cheapest ever purchased because there was absolutely no loss and no difficulty with subsequent fabrication.

At the present time there are no engine lathes in the production line although it was long considered impossible to secure the desired limits of accuracy on turret lathes or screw machines. Proper tooling and careful maintenance of equipment has made it possible to secure practically the same limits from the higher production machines and they are now in use in the line. No scraping is done on bearing surfaces because the machine tools are in such shape that they produce a bearing surface that cannot be improved by scraping.

Although the best in equipment is an important factor in the results achieved in this plant it is of no greater importance than the treatment of the employees. There are today 28 men in the plant. No man has ever left voluntarily which is not surprising in view of the fact that the men are on a weekly salary which continues during illness and includes a ten-day vacation with pay. Several years ago it became evident that there was a trend toward abolition of Saturday work. At that time Mr. Goldberg called the men together and asked how they felt about working on Saturday mornings. After some discussion it was agreed that regular Saturday work would be abolished. Although no time was added to the other five days the total output of work per week did not diminish. It is not unusual to see eight or ten men in the shop on Saturday morning catching up with the weekly requirements where they may have had a little hard luck and have fallen behind. This, of course, is entirely voluntary.

Where a new man is taken on he is not put on the weekly salary basis without a period of trial. He is given at least six weeks to find out whether he will fit into the organization and if he does is carried on an hourly basis for at least six months. If at the end of that time he has proved his proficiency he goes on the weekly basis.

There is no formal training program in effect. New men usually start in the stock room to gain familiarity with the product and are moved from there to a machine when they express the desire and the machine is available. They are shifted from machine to machine in an effort to find out what part of the work they like best and are assigned to that work as soon as it becomes possible to do so.

Twice a year there is a distribution of bonus money based on the judgment of the works manager. A week before Christmas last year a substantial sum was distributed to the 26 men on the pay roll, and a similar payment was made a few days before the plant vacation shutdown which takes place about the fourth of July.

The toolroom is provided with modern machine tools and the very best of tools and measuring instruments

As was stated earlier in this story there are no inspectors in the plant because it was found unnecessary to check the work of men operating on the basis described here. The weekly wage payment is probably largely responsible for the success of this enterprise. It has been in effect since 1913. Obviously it is not a policy that can be adopted over night in a plant without the proper tradition of craftsmanship and loyalty, but the fact that it has been made to work so well by the Haskins company is proof that it is an ideal that is well within reach of other companies.

Spindle Nose Standards

After fifteen years of work A.S.A. Sectional Committee secures agreement on standards for spindle noses and chucks on turret and automatic lathes

J. E. LOVELY
Vice President and Chief Engineer, Jones & Lamson Machine Company
Chairman Technical Committee No. 4

IN 1922, under the procedure of the American Standards Association, a Sectional Committee was organized to develop standards for small tools and tool holding elements. This Sectional Committee set up a number of technical committees to handle subdivisions of the project, and operated under the sponsorship of the National Machine Tool Builders' Association, the American Society of Mechanical Engineers and the Society of Automotive Engineers. Technical Committee No. 4 was given the job of standardizing spindle noses and collets for machine tools. This committee has finally produced a standard for spindle noses for turret lathes and automatic lathes, and it has passed through the various steps leading to adoption as an American standard as of November, 1936.

There can be no argument over the desirability of agreement on a standard spindle nose that permits interchanging of chucks and fixtures usually attached to the spindle nose of a machine tool. The committee is convinced that the standard adopted furnishes a more rigid mounting of chucks and fixtures than any heretofore available, and that it provides an accuracy of alignment formerly considered unattainable. It also removes the danger of chucks coming loose at high speeds when the spindle brake is applied, or when the spindle is reversed. Exchange of chucks is made a quicker and easier operation.

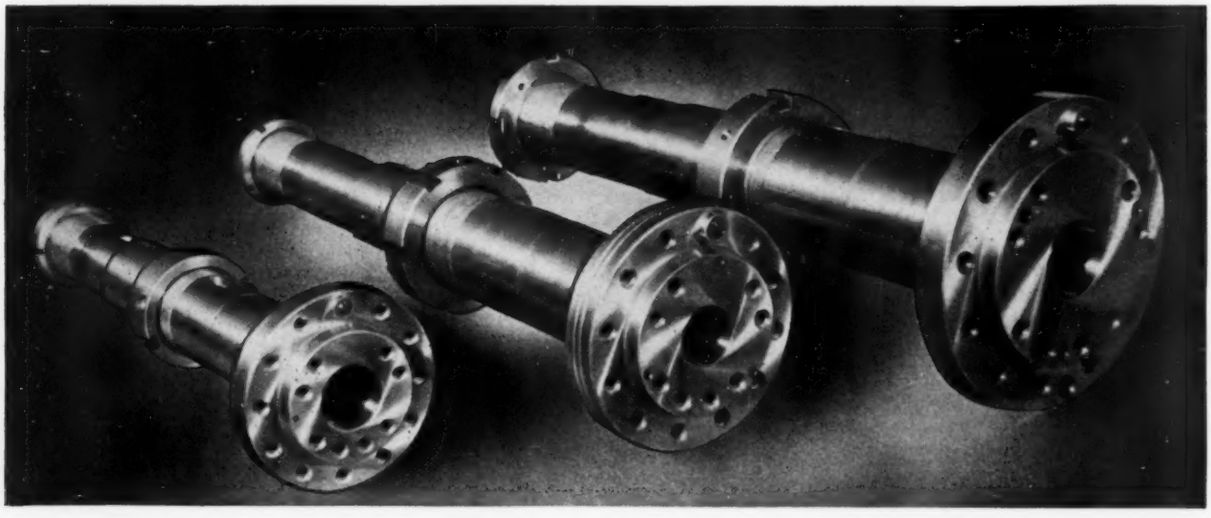
The standard was approved by the Turret Lathe and Automatic Lathe Groups of the National Machine Tool Builders' Association two years ago, and is now available on most of the new models of turret lathes and automatic lathes made in this country today.

Some idea of the general characteristics of the new standard spindle nose may be gathered from Fig. 1 which shows three of the Type Al spindles. The complete series includes two larger and two smaller spindles. The largest standard nose is the 20-in. nose and it will accommodate holes up to 15 in. in diameter.

A cross sectional view of the Type A, B and C chucks and also a view showing the spacing of the holes are included in Fig. 3. Fig. 2 shows a turret lathe with the cam lock type of spindle nose, 6-in. Type D1, and with a 10-in. standard chuck ready to be attached. The chuck is held in position on the spindle nose by means of the six cam lock studs shown projecting from the back of the chuck, which are engaged by the cams provided with square sockets in the flange of the spindle nose. This Type D1 nose is shown in detail in Fig. 5. It provides means for a quick change of chucks and fixtures and is recommended for use where changing time must be kept to a minimum. Both the Al and Dl spindles have taper pilots of the same diameter, and the location of the outer bolt circles is the same, to provide for interchangeability of chucks and fixtures between the two types.

All of these spindles are provided with a taper pilot, and all fixtures

Fig. 1 — Three of the seven standard spindle noses. There are two larger and two smaller



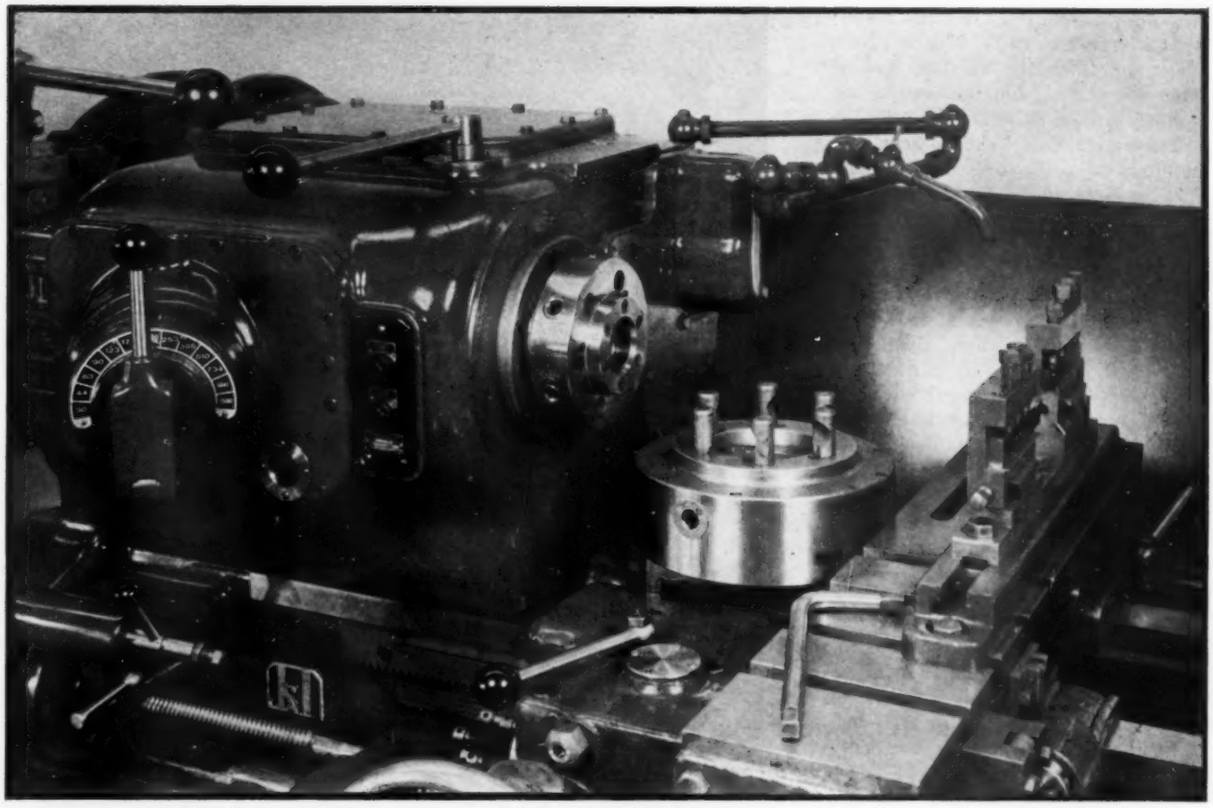


Fig. 2—Chuck to fit the cam lock type of spindle nose. This is for use where frequent quick change is necessary

and chucks are made to give a tight fit on the pilot when drawn back against the flat face. This feature allows the spindle to be reconditioned at any time if the pilot wears or the face is mutilated. The original size on the pilot may be obtained by grinding back on the face and regrinding the pilot.

Technical Committee No. 4 has cooperated continuously with Technical Committee No. 11 on chucks and chuck jaws. New American standard chucks to fit the new standard spindle nose are now in production and may be obtained from most of the chuck manufacturers. They may also be secured as regular equipment through any of the machine tool builders making machines with the standard spindle.

A standard chuck of the 15-in. size in the medium duty series is shown in use on a turret lathe in Fig. 4. Sizes of standard chucks range from 6 to 36 in. in eleven steps. They are made in three classes: I—Medium duty for application to engine lathe and other turning machines where the service is not severe, and chucks must be handled frequently; II—Heavy duty tongue and groove jaw type for application to turret lathe and other machines where the service is such as to require heavy grip; III—Heavy duty serrated type for application to turret lathes requiring the utmost in holding means.

The standard for chucks and chuck jaws was completed by Technical Committee No. 11 in 1935. Formal approval by the sponsors (same as for spindle noses) and by the A.S.A. was concluded in November, 1936. Copies of the complete standard may

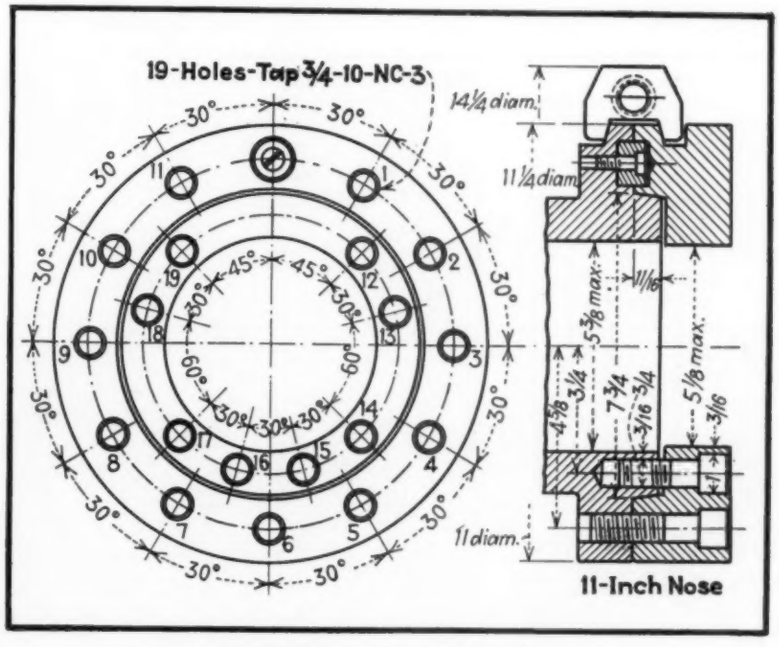


Fig. 3 — Cross section and bolt hole spacing of 11-in. Type A, B or C chuck

be obtained from the American Standards Association, 29 W. 39th St., New York, or from the sponsor bodies. The cost is $.45, and the designating number is B5.8-1936.

These standard chucks can be mounted directly on the standard spindles without having to be fitted individually. The taper pilot and the flat face on the spindle insure that the chucks or fixtures will run true within a fraction of a thousandth even when they are transferred from one machine to another. The rigid mounting employed is particularly adapted to the high speeds encountered in manufacturing practice today, and aids materially in meeting the standards of accuracy currently demanded.

So far these new spindle noses and chucks have been approved and accepted by the American Standards Association for turret lathes and automatic lathes only, but the Sectional Committee on the Standardization of Small Tools and Machine Tool Elements, as well as its technical committees connected with this development, feels that they are equally adapted to engine lathes and hopes that their use will finally become universally extended to engine lathes by all the prominent builders of these machines. These spindles may be used equally as well on the work spindles of grinding machines, as well as many types of special machines.

Dimensions, specifications and working tolerances of these new American standard lathe spindle noses are given in a pamphlet now available, entitled "American Standard Lathe Spindle Noses for Turret Lathes and Automatic Lathes—Bulletin ASA B5.9-1936." This pamphlet may also be obtained through the American Standards Association or through the sponsor bodies. It costs $.50.

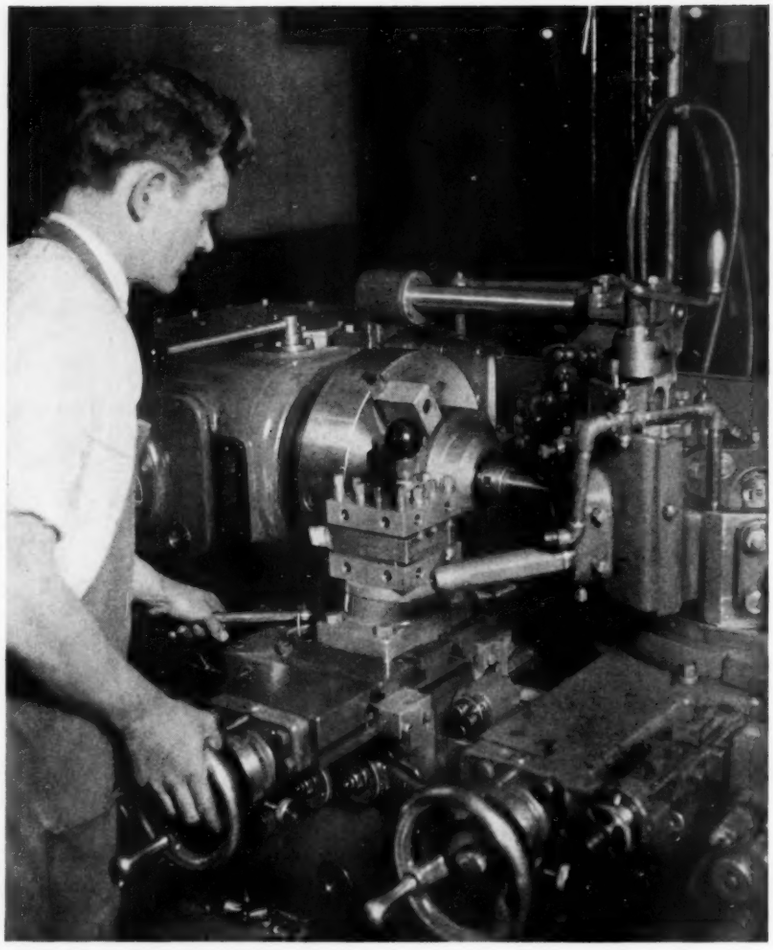
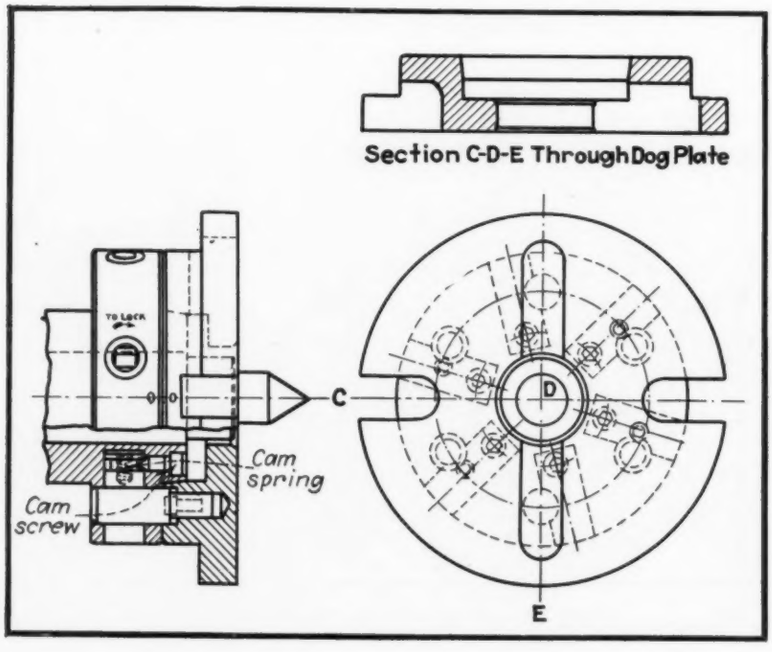


Fig. 4—A 15-in. medium duty chuck in use on a turret lathe

Fig. 5—Details of 6-in. Type D1 cam lock nose



This pamphlet also contains complete information on the various gages to be used in manufacturing these standard spindle noses and chucks. Master gages of the plug and ring type, and outside and inside micrometer working gages, are recommended for measuring the taper pilots and the mating taper holes in the chucks and face plates. Each of the master ring gages is made to correspond with the mating plug gage, and so that surfaces are a good Prussian blue fit.

Micrometer working gages will be found convenient for manufacturing spindle noses as well as face plates and chucks. These gages are set to the master ring and plug gages, and will then read the pilot diameters direct.

How Shall We

LUBRICATE?

Filtration is the best means of removing dirt and other foreign matter from lubricating oils

M. P. HOWARD

MAINTENANCE men once confined their activities to repairing machines and other equipment after they went bad; today real maintenance is not a "fixer's" job, but a "preventer's" job. Realization of the need for preventive maintenance will lead naturally to an understanding of the need for intelligently applied lubrication in every line of industry.

The problem of how we shall lubricate and to what type of men we shall entrust this activity is of utmost importance. In the hands of trustworthy, interested and well-paid men this essential duty can be made to pay dividends because of prolonged accuracy as a direct result of better care of machine parts. A machine whose lubrication is entrusted to a non-descript workman, who is interested only in his pay envelope, is on the down grade—on the way to some cupola at an ever increasing pace.

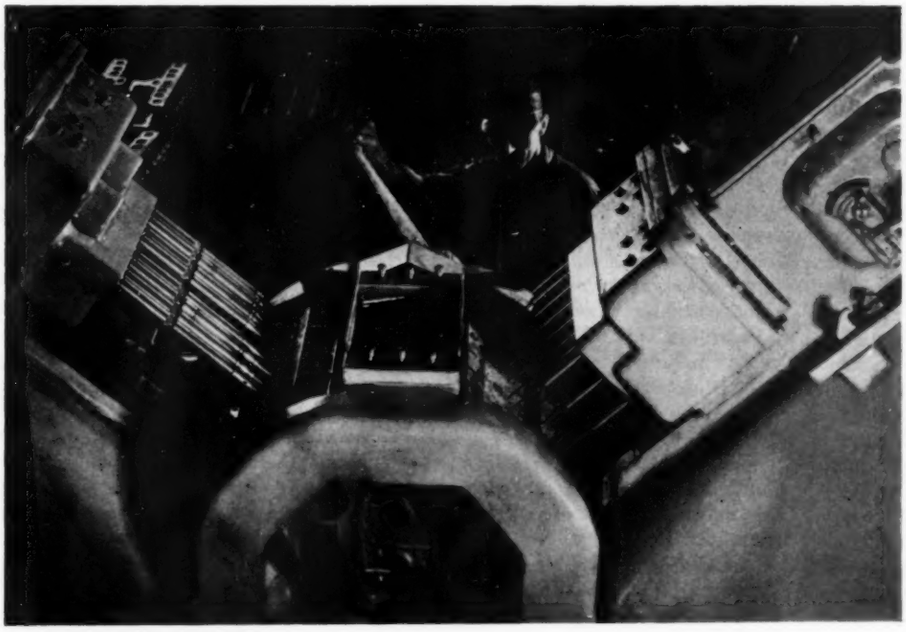
Evidence that lubrication has been coming in for increased attention is given by the increasing applications of completely sealed anti-friction bearings, dirt-tight oil wells and sumps, better coverage of exposed parts and the extended use of filters. The menace of dirt is admitted.

Let us examine some of the present day schemes of lubrication, using a typical production machine shop as our "guinea pig" and see what machine owners and their maintenance men are up against in the way of service requirements. We can set up a hypothetical, but entirely possible condition; suppose, for instance, that the owner of a manufacturing plant, desiring to modernize some of his equipment, has ordered a number of drill presses of one make, a number of larger drills of another make, several milling machines and a couple of grinders.

When the first group of drills arrived they were found to be splash lubricated, the maker stated that he had found this the best system of all. Then the second group of drills arrived and these were found to be grease gun lubricated, this maker having declared that no other system was good enough for his machines. Upon arrival of the milling machines it was discovered that they were force-feed lubricated. Finally came the grinders and these were found to be equipped with cascade lubrication and with oil cups for the spindle bearings.

Here is presented just a small picture of the problem a plant oiler must meet in his travels through a department. For the first group of drills he needs, in addition to numerous tools, oil in bulk and probably a funnel to fill the sump or tank. The second group of drills requires a grease gun and bulk grease to refill it.

When the plant oiler moves on to the milling machine, he finds that here, again, he must use bulk oil. However, as these machines are equipped with anti-friction bearings, a different grade of oil is required. The funnel has by this time gathered a good collection of foreign matter by reason of being carried through the dust and grit of the shop; this accumulation is soon to be washed into the force feed lubrication system and then to the bearings. Finally, at the grinders he again needs bulk oil, but of one grade for general use and an-



Modern machine tools can be made to pay continued dividends as a direct result of better care of bearing surfaces

other for the cups on the wheel spindle as this runs in high-speed antifriction bearings.

We have, then, both old and new machines lubricated by (1) cascades, (2) splash, (3) force-feed oil, (4) force-feed grease, (5) hand-pressure grease gun, (6) sight-feed oil cups, (7) sight-feed multiple oilers and various combination of these and other systems. In the cascade and splash systems, oil is raised by pump or splash vanes to levels above the points to be oiled. The oil returns by gravity to the sump after having been led by troughs or spouts to the parts requiring lubrication. Systems of these types are effected by shop temperature; low temperatures may change the viscosity of the oil, impeding its progress through the system. Furthermore, means for removing dirt and other foreign matter from the oil are seldom possible. This foreign matter is constantly washed back to the sump and then recirculated to the bearings. In the splash system, particularly, precipitation of the foreign matter is not effective because of the continuous agitation and recirculation. Neither of these two plans offer any means of knowing whether or not the oil is flowing to the proper points.

Force-Feed Systems

Force-feed type systems, employing the conventional mechanically operated, force-feed pump with multiple outlets, are well-known and are highly efficient when properly cared for. As a rule, tubing is used to convey the oil from the force pump to the bearings. This tubing being of brass or copper in most instances, is subject to breakage from vibration, violence or carelessness. Often this system is without means of removing dirt and foreign matter from the pump body other than by means of a screen. It can be argued that since only new oil is used, and this is not re-circulated, there is no danger. However, no operating man will question the statement that while the oil may be clean when it leaves the barrel, it is subject to many chances for contamination before it is safely in the lubricator. For instance, dirty oil cans that convey the oil to the lubricator, unclean location of the latter, carelessness on the part of the man who does the oiling and other shop conditions will permit dirt to enter the lubricator.

Force-feed grease systems are in practically the same category as pressure-feed oil systems with regard to tubing and other details, and provide additional hazards that must be carefully watched. In this type system, grease under pressure moves from a central point to any number of points. When it is considered that grease is simply oil thickened with a filler, the filler usually being brown laundry soap, or some undesirable impurity, it is not hard to understand why care must be used in operating a pressure grease system. Further, in this system, restricting fittings having holes of proper size to insure the correct amount of grease leaving the exit to serve the bearing are used. The holes vary in size and it is possible for the smaller sizes to become plugged with foreign matter carried in the grease. It may be argued that the pressure exerted by the pump is sufficient to force these foreign bodies through the orifice; but, even if this is granted, who wants foreign matter in a bearing?

Hand-Pressure Greasing

Next on the list is the hand-pressure grease system and here we have the same condition as in the above system. However, these are aggravated somewhat by the fact that the gun must be refilled oftener and so is exposed oftener to extraneous foreign matter.

The conventional sight-feed oil cup is one of the oldest lubrication systems and its evolution is interesting. It started in the days of whale oil, fed from any receptacle that would hold oil and allow it to drip or feed to a bearing or moving part. It progressed through many steps and in its present form is used wherever wheels turn. The sight-feed oil cup fell into some disrepute when it was discovered that dirt found its way through the cup with the oil. After trying many plans to correct this condition, the oil cup was perfected a few years ago to the point that no matter how dirty the oil was when it entered the cup, none could get out into the bearings. This was accomplished by incorporating a highly efficient, cleanable filter in the construction of the cup. The sight-feed oil cup offers a further advantage in that a constant check is possible as to whether or not oil is entering the bearing.

Sight-feed multiple oilers are in the same category as the single-feed cup and may also be corrected by the use of filters. If one is willing to concede that tubing to carry the oil is not objectionable, then this system has many advantages. Filters for lubrication systems are now receiving particular attention; any system not incorporating them is omitting the most potent means for keeping dirt out of places where is does not belong. These filters must receive proper care. Since they are the heart of the machine's system they must be cleaned regularly and worn elements replaced when necessary. Regardless of how clean lubricants may be when new, or the effectiveness of the system in keeping out impurities, lubricants become unfit for use unless kept thoroughly clean.

Here lies one of the dangers of pumps and reservoirs that do not permit and do not receive complete and frequent flushing, or do not incorporate a filtering system in their construction. Grains of sand, loosened by circulating oil, iron oxide formed by moisture, dust and dirt from the atmosphere or accumulated from any other source, all must be removed from the oil if safe lubrication is to be maintained. It is obvious that contamination must be removed continually, or at very frequent intervals, if wear is to be prevented and the accuracy of the machine maintained.

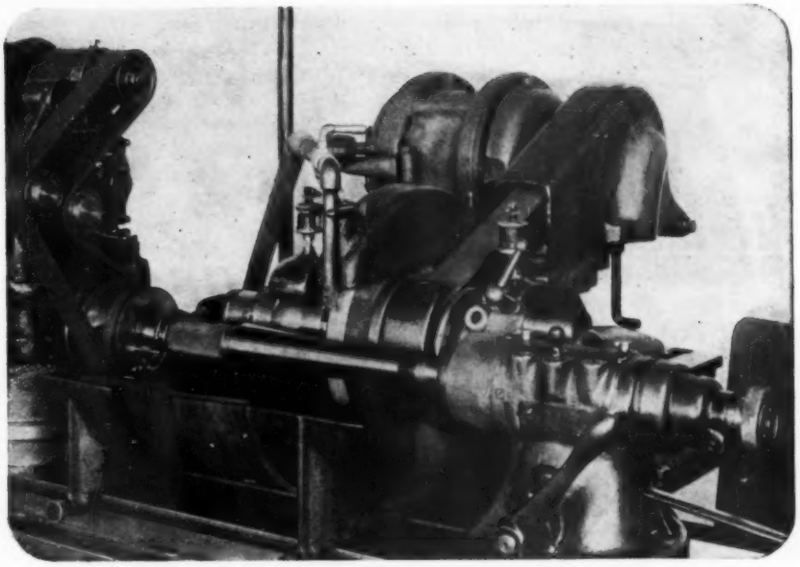
Cutting Compounds

Another factor seriously affecting lubrication in certain types of machines is the use of cutting compounds. This is particularly true where the machine is lubricated by oil drawn or circulated from a sump located inside the machine. Cutting compounds that contain soap, caustics or water will, in case they enter the circulating system, create an emulsion resembling sludge. This emulsion is just about the worst thing that could come in contact with any bearing surface, especially highly polished ones such as are used in most present day machines. There are other compounds that do not contain these dangerous components, but these are compounded as coolants, not lubricants, and so must be excluded from all bearings.

In the last analysis, lubricating devices that permit of visual inspection of contents, flow, feed rate and contain an effective means of preventing foreign matter from reaching moving parts, stand pretty near the top in providing safe machine lubrication. While there was for a time a tendency to conceal everything pertaining to lubrication, there is a noticeable trend in the opposite direction that will, no doubt, result in a better understanding of the importance of intelligent lubrication.

Lapless Gages

H. J. WILLS
Carborundum Company



A new toolroom grinding technique produces fine finish without resort to a lapping operation

ULTRA-FINISH grinding has recently found a definite place in the toolroom. Plug and ring gages may be economically and satisfactorily ground to close dimensional limits and high finishes without resorting to lapping processes.

It has always been thought that grinding was not accurate enough for gage work. It is now a known fact that dimensional tolerances are controlled by the degree of machine perfection, wheel characteristics and operator's skill. The second qualification for gage work, namely, surface smoothness, which is necessary to insure long life, is now easily obtainable through recently developed Aloxite aluminous oxide resinoid wheels, products of the Carborundum Company.

Heretofore, it has been necessary to use a series of wheels of progressive fineness to generate a good surface and polish. With each change of wheel, especially if the gages are in quantities wherein a number are ground with each wheel, the chances of error in dimension are multiplied. With the new ultra-finish wheel, a necessary cut is maintained, making it possible to use either a one or two wheel set-up. This cut is absolutely essential for accuracy in dimension and surface qualities.

With this method of gage grinding it is unnecessary to use roughing wheels except when grinding gages to a smaller size in the case of a plug or a larger size in the case of a ring gage. When any of these gages are built up by plating, the foundation surface is sufficiently fine to take a thin plating and at the same time it is possible to grind the chromium plate without resorting to a roughing wheel.

It will be readily seen that such a radical change in method of finishing gages will require some specialized operation. Assuming that the grinder is maintained to a practical mechanical perfection (and of course, this is essential) then the problem is merely one of manipulation. Like all grinding wheels on precision work, there are two distinct cycles in its manipulation. The first or roughing cycle* requires a fine but sharp dressing operation, and when applied to the work, the wheel should be used at a slow speed, preferably around 2,500 s.f.p.m., and at a fast reverse speed to keep the wheel cutting freely. When the work has been reduced to size, allow wheel-work contact to become very light (spark out), then the traverse rate should be dropped to the absolute minimum without a dressing operation. Under the lower traverse rate the wheel face should glaze rapidly, and a few passes after glazing should be sufficient to apply the required luster to the surface.

Coolants play an important part in this ultra-finish grinding. The best practice is to use clear water for the grinding cycle and soluble oil in grease form applied directly to the work for the secondary or polishing cycle. In this case the grease can be applied through a cloth bag held directly against the work with a reduced supply of water from the coolant nozzle.

Not only does this method of finishing gages entirely eliminate a lapping operation but in special cases, such as ring gages, one does not experience the annoying bell-mouthing that is generally caused by lapping with loose abrasives. At the plant of the Brown and Sharpe Manufacturing Company the grinding method of finishing gages has been found particularly advantageous in the grinding of tapered plug gages since the lapping of these tapered gages is unsatisfactory at best. This would also apply naturally to tapered ring gages.

Precision spindles for machine tools are often ground in the toolroom. By using the same procedure as for gages, an accurate bearing surface may be generated with a minimum of friction producing surface roughness.

Cutting tools, such as reamers and mills, have longer life and produce better finishes when reground with ultra-finish wheels.

Where commercial lapping machines are not available these ultra-finish wheels may be used economically for finish grinding follower pins for dies blocks and cutting edges for blanking dies.

* For general ultra-finish grinding on tool steels, chromium plate, Nitralloy, etc., the grading would be KHM-6-K6Y, but conditions may vary, wherein other grades or bonds may be better suited to the job.

Drawing Systems *and* Tool Classifications

C. W. HINMAN

V—A well integrated drafting-office system facilitates good designing, allocates costs properly and saves patching inferior jobs in the toolroom

THERE ARE several methods in use for conveying mechanical information on drawings. Each one fits a locally devised cost accounting system used in some particular manufacturing organization. The most comprehensive method is the piece part system. In this plan a complete assembly design is drawn on one or more standard sheets, with detail numbers assigned to each part. Detailing the intricate parts is usually the responsibility of the senior designer, and the development of the remaining parts is given to several junior draftsmen who work under senior supervision. Each detail is drawn on a separate sheet and is assigned an individual part number. The sheets are small, about 6x9 or 9x12 in. in size. The shopman charges his time against the part number of the piece he makes. In the cost department an overhead charge is added, and the final cost of each part is immediately available when finished. This system provides a convenient check on daily costs. If the part is a casting, the same procedure is followed, and the charges of a patternmaker, foundryman, machinist and toolmaker all appear under the same part number in the cost accounts.

When starting a new design, an order number is issued covering the entire machine. To this number is charged designing and drafting time, cost of materials and commercial parts, machine-shop assembly time, trying out and numerous changes. The separate costs of all the many items are thus obtained. If the practicability of a new design is questionable, an experimental order number is issued, but the costs are handled as just described.

To the usual objection that this system requires the maximum of drafting, filing, and cost keeping expense, the answer is that the extra cost is more than off-set by pecuniary gains in the shop. Several mechanics, each provided with his own print, are enabled to work on different parts simultaneously which expedites the work; individual part costs are quickly checked each day, and with the thoroughly detailed piece parts, the busy shop foreman is relieved of many explanations which he is not always prepared to make. Another advantage is that small prints are convenient to handle, and unlike large sheets, do not cover the workmen's bench. This method eliminates the errors which surely occur when slip-shod, or no, methods are used in giving working orders in the shop. It is of utmost consequence that strict accuracy should accompany shop instructions. One should therefore acquire the power and habit of expressing his verbal and written orders with perspicuity and correctness.

The system in common use is to detail the parts on large sheets together. The sheets are the same size as the assembly drawing, or a size smaller. In this case there is no check on the labor costs of individual parts, and aside from material expense and outside purchases, the final cost figure merely covers the entire machine. Another system is to use the job number for the drawing number, and sub-number the drawing sheets in rotation. The objection to this plan is that numerous numbers are issued for work where drawings are unnecessary, and consequently there are frequent breaks in the drawing-file numbers.

Last to be mentioned is the jobbing shop drawing, or shall we say system? Drawings are made on the backs of blue prints, or on wrapping paper, with no border lines or title. "Just something to get it into the shop quickly." These sketches, mostly free hand, often specify some queer materials. For example: The use of cheap commercial parts intended for other purposes, to save time and fabricating expense. Wrought-iron pipe T's, pipe elbows, and pipe fittings with floor flanges are specified for frames. Truck castors with the wheels removed and the yokes turned up side down for treadle fulcrums, awning hinges for links, and pans from the "5 and 10" for hopper heads. It is surprising how many really useful parts for cheap fixtures can be found "ready made" in the catalogues of large wholesale hardware concerns.

Planning the Drawing

If drawing paper is not economically cut, especially in large offices, the waste in a year is enormous. The highest economy in cutting drawing paper is dependent on the multiple relation of the sizes cut to the length of the stock roll. If the length of the paper roll is 36 in., the largest standard sheet is 24x36 inches. This size is usually adopted because the smaller sheets made from it, 18x24, 12x18, and 9x12 in., are common convenient sizes. Prints 8x12, or even 6x9 in. are suitable for small standard part drawings, made for office and shop reference books and placed between loose-leaf binder covers. The foregoing drawing sizes are also close approximations to the product designer's so called "golden rectangle of perfect proportions" in which the width of a rectangle is made 62 per cent of its length. If a larger sheet than 24x36 in. is needed, one 36 in. wide and of any length can be used.

The correct types of drafting equipment were described in the first installment of this series (*AM*—Vol. 81, page 9), but mention is made again that every designer in the exercise of his art should be supplied with proper implements. In drawing the assemblies of tools and machines, there are at least two major views, but sometimes three or four are necessary. The plan is the upper left hand view, while the front elevation should be the view of the contrivance as seen in front of the operator when using it. This view is projected down from the plan just above it. The precaution in showing the front elevation as the operator's view of the device cannot be overstressed because a drawing is difficult to understand if this is neglected.

If the practicability of a tool or machine gains clearness by showing either or both the right- and left-hand projections of the plan, these should be added. If a left-hand view is necessary, there must be sufficient space for it at the side of the plan. Views should not be crowded, nor approach the border line nearer than two inches. This naturally suggests that before starting a design, unless a very simple one, preparatory sketches should be plotted and the approximate sizes of the views determined before one is able to plan his drawing or to choose the proper size of drawing sheet. One or more section views can be taken on a plane cutting through the assembly at the most advantageous places for clearly presenting interior constructions, and assemblies when necessary.

Piece parts should not be detailed on assembly sheets, but significant center distances, and important dimensions relative to the final assembly of outstanding parts should be there. Detail numbers are assigned and inclosed in ⅜-in. diameter circles, with a line leading from each circle to an arrow point touching its designated part. Assign the detail numbers beginning with the larger pieces, usually the castings, then in rotation, assign numbers to the correlated parts.

On assembly drawings for drilling jigs, besides the drill bushing sizes, the only necessary dimensions to give are those that locate the registering or gaging points for the work, and from these points to the centers of each bushing. The body, leaf, and other working parts are of course detailed separately on other sheets.

The drawing of views in the "third angle" is the method universally adopted, in America at least, for showing the views of an object on paper with the purpose of presenting its other sides. This method is graphically illustrated in Fig. 31, in which *A* is a rectangular sheet of transparent glass. The object *B* is secured on *A*, and is assumed to be the plan. The observer is looking directly at the plan in the lower view, and at right angles to the glass. Obviously when the glass is revolved horizontally 90 deg. in a clock-wise direction, the plan of the object will enter the first angle, and appears as shown at *C*. Likewise another turn of 90 deg. in the same direction brings the object into the second angle view at *D*, and by another continued turn of 90 deg. it appears as shown in the third angle at *E*, from which this view takes its name.

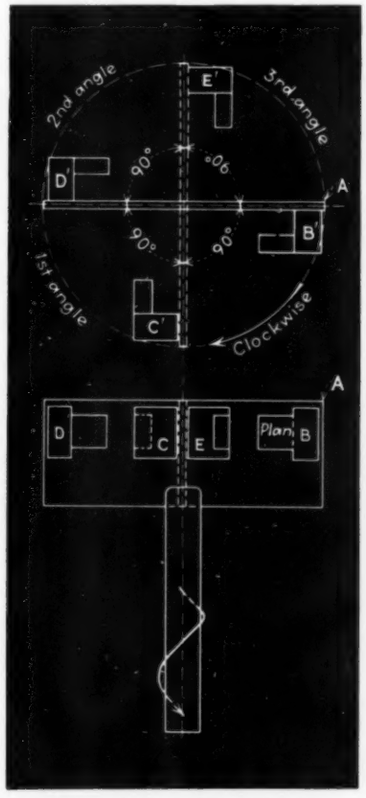


Fig. 31—Third-angle projection is the universal method in America for showing views of an object

Tool Classifications

Dictionary definitions of many commonly used mechanical words and terms do not often coincide with the meaning as understood by those in the trade. For example, the group of tools classified as "jigs" is used for locating and holding a piece of work, and is provided with means accurately to guide a revolving cutter in producing holes, or in operating in the holes of the work, and generally but not necessarily used on a drilling machine. This class comprises: Drilling, reaming, boring, spot centering, counterboring, countersinking, and tapping jigs.

In interchangeable manufacturing the word "fixture" designates a tool which does not belong in the jig classification. This tool requires no members for accurately guiding revolving cutters. It is generally found in use on a milling machine. However, the word fixture covers a very large family of tools. There are: assembling, broaching, hand reaming, filing, shaping, riveting, spot-welding, stamping, heating, tempering, electroplating and many other types of fixtures.

Press tools for blanking, shearing, piercing, bending, and drawing various materials are in a classification of their own, and consist of all the tools used in the many types of punch press machines. A comprehensive classification of these tools, in convenient diagrammatic form, has been published (*AM*—Vol. 78, page 637).

There are a large number of other tools not properly belonging in any of the foregoing classifications. These are commercial and special hand tools such as dinking dies and gages, also screw-machine tools, perishable tools, forging tools, molds and appliances for handling plastic resinoid materials.

In the next installment, the design and use of hand tools will be discussed.

Part VI of Mr. Hinman's series will appear in an early number.

Two Crane Shop Tools

FRANK C. HUDSON

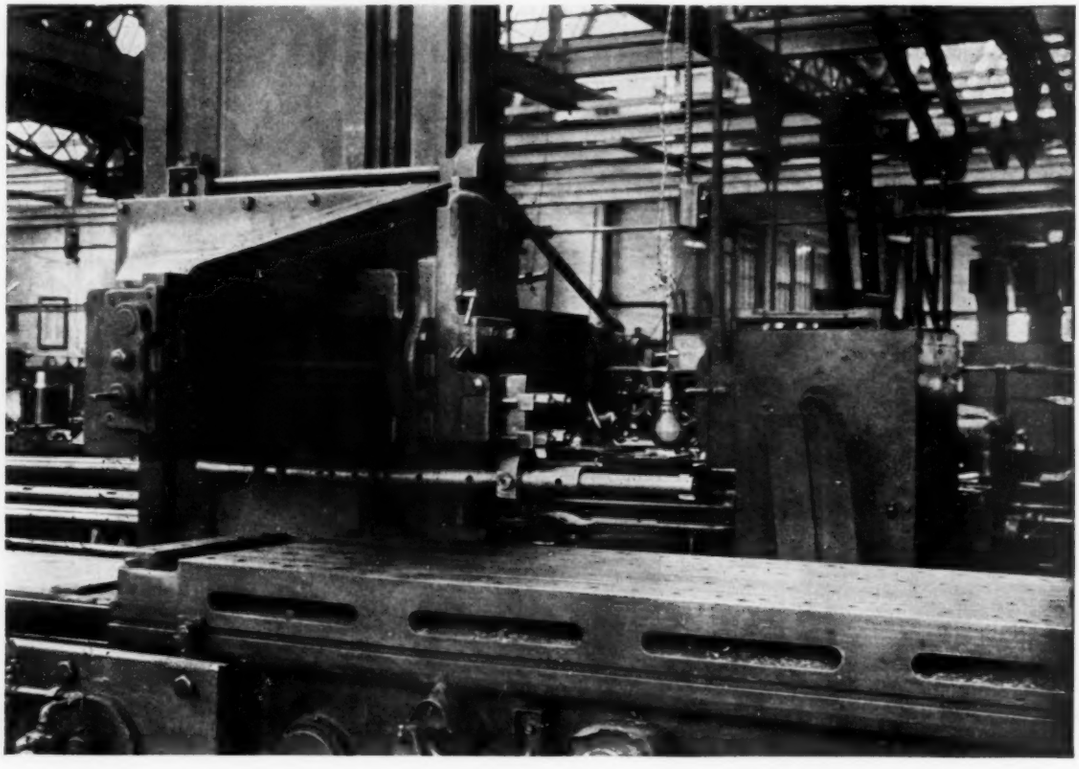
CRANE building has several operations that requires special tools. One is the boring of widely spaced holes in crane bridge members, as shown above. The two boring machines are mounted on a large floor plate and have a wide range of spindle movement both vertically and horizontally. The beam in front of the spindles has been bored at proper center distances.

The type of work support used is also shown, two being under the beam itself. These support the work at a convenient height and are easily handled by overhead crane and placed in any desired position.

Another machining job, or rather the tool for it, is shown below. The cast hoisting drums are mounted on steel shafts and keyed. The drums are too long to be keyseated on a vertical machine. So the open-side planer is brought into play, the drum being held in V-blocks in the usual manner.

The keyseating tool bar is also shown. The bar is supported in a trunnion that is mounted in the tool post while a sort of stirrup surrounds the back end of the bar. The trunnion permits the tool to be relieved on the back stroke and so prevents dragging in the cut. This bar has worked out satisfactorily in handling work of this kind.

These views are from the shop of the Shepard-Niles Crane and Hoist Corporation.



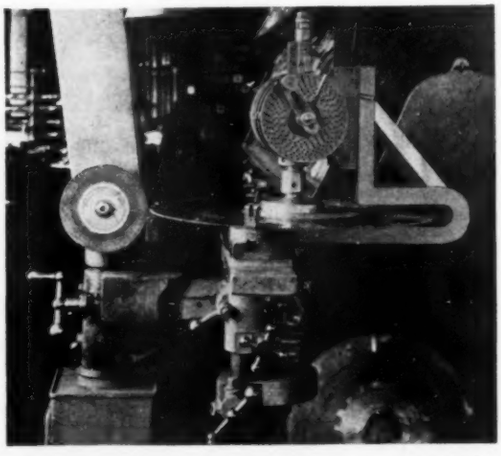
Ideas from Practical Men

Reconditioning Saws for Cutting Metal

E. G. WILLIAMSON
Toolroom Foreman, B. & L. E. R. R. Greenville, Pa. Shops

Reconditioning circular saws for cold-cutting our locomotive boiler flues to length was a job that had to be done by the maker of the saws until we devised the set-up shown.

The saws are used in a Ryerson sawing machine and run at 5,600 r.p.m., cutting under water. From 800 to 1,000 flues, 5½ in. outside diameter, can be cut before the saw needs resharpening. After about three sharpenings, the teeth are too short and have to be ground off and recut, requiring about 8 hr. The saws when new are about 26 in. in diameter and have 320 teeth. When recutting the teeth, the number of teeth is lessened to compensate for the decreased diameter, the depth and the pitch of the teeth remaining constant. A saw can be retoothed and used for cold-cutting flues until it is about 23 in. in diameter and can then be used as a hot saw for cutting flues to length after they are safe-ended.



For sharpening and retoothing, the saw is held on an arbor in the spindle of an indexing head mounted on an angle-iron fixture

In operation, the saw is held on an arbor in the spindle of an indexing head mounted on an angle-iron fixture attached to the machine table, as shown in the illustration. A small jack placed under the saw near the periphery prevents the saw from springing under pressure of the cut. A medium coarse, hard wheel, about equal to a Norton P, is used. The wear on the wheel is almost negligible.

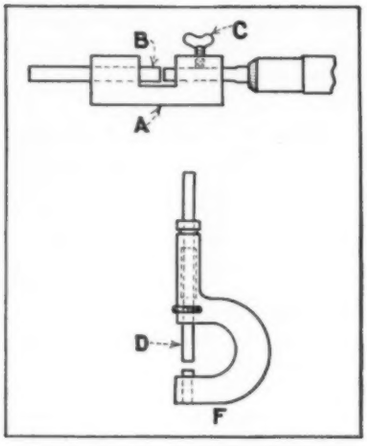
Micrometer Repaired by Simple Laps

ANTONIO CLADAS

For lapping the end of a micrometer spindle, I made the machine steel block shown at *A* in the illustration. One end is bored a close fit for the spindle and the opposite end is bored $\frac{1}{16}$ in. larger for the lap. The lap *B* is a piece of drill rod ground to fit the hole and square on the end.

With the spindle removed from the frame and locked in the block by the thumbscrew *C*, the lap is inserted and the end is lightly coated with fine lapping compound. For this operation, the block is held so that the spindle is horizontal and the lap is oscillated by hand, the oscillations being short at the start and gradually increasing to full turns.

For the anvil lap *D*, a piece of drill rod is ground as previously, but in two diameters to fit closely both ends of the spindle bore of the frame. Lapping is done in the same manner as described for the spindle, but the micrometer frame is held vertically, as at *F*, to prevent possibility of the lapping compound reaching the spindle bore, and to prevent the weight of the lap from being borne by the wall of the bore.



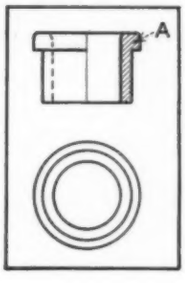
Laps B and D are pieces of drill rod ground flat on the ends and for a close fit on the diameter

Before removing either of the laps, the assemblies are washed in gasoline to remove all traces of the lapping compound. Nothing but fine lapping compound is used. The ends of the laps should be reground after each lapping. The laps and the block will last for at least a dozen lappings.

Improved Jig Bushing

MARTIN H. BALL

Due to inaccuracy in the squareness of the table with the spindle in some drill presses, a slight automatic adjustment is made by the drill as it enters the bushing. This action tends to wear the outer corners of the cut-



Raising the center from which the inner arc in a jig bushing is struck, eliminates some of the wear on the outer corners of the cutting lips of the drill

ting lips in proportion to the abruptness with which the drill contacts the rounded end of the hole in the bushing.

The improvement in the bushing illustrated consists in raising the center *A* from which the arc in the inside of the bushing is struck, making the bushing more funnel shaped and permitting the drill to contact it less abruptly. Some of the wear is thus transferred from the outer corners of the cutting lips to the sides of the drill where less harm is done, thus affording longer use of the drill between grinds.

Planer Fixture Swivels to Machine an Arc

CARL HOFFMAN

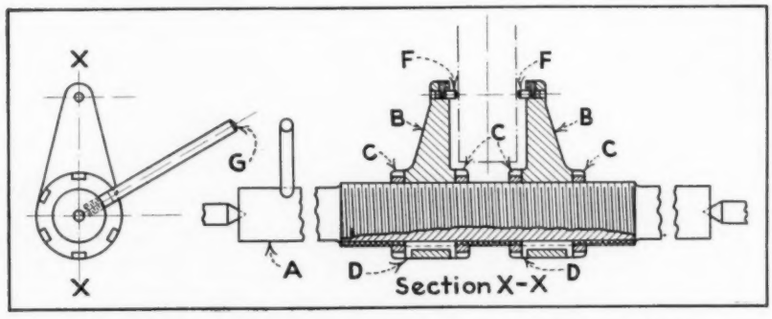
Referring to the article by J. R. Whittles under the above title (*AM*—Vol. 80, page, 1053), the fixture described will not swivel as the planer table travels unless the circular gib *F* is mounted on the planer bed, which means that it must always remain in the same relative position to the pivot pin *C*.

Fixture That Dresses Both Sides of Wheel

J. R. WHITTLES

Illustrated is a fixture for dressing both sides of the abrasive wheel in a cylindrical grinder at the same time. Since an important feature in a fixture of this kind is rigidity, it has been made very heavy.

The mandrel *A* is 4½ in. in diameter and has threads of 16 per in. cut in the central portion to permit close adjustment of the diamond holders *B* by the nuts *C*, which are operated by a spanner wrench. The diamond holders are bored to clear the threads



Both sides are dressed at the same time to a predetermined thickness

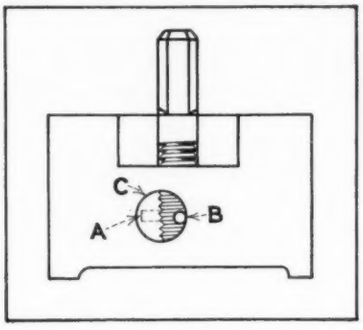
in the mandrel and are prevented from turning thereon by the double-gibbed feather keys *D* engaging a keyway. The diamond settings *F* fit in holes in the upper parts of the holders and are held in position by setscrews.

In use, the mandrel *A* is mounted between the centers of the machine and is swiveled to feed the diamonds in an arc on the sides of the wheel by the lever *G*. Thus, by adjustment of the diamond holders by their nuts, the wheel can be dressed to a predetermined thickness.

Stop for Jig-Leaf Screw

H. MOORE
Hamilton, Ontario, Canada

In using a jig having a hinged leaf, the clamping screw sometimes works around when the jig is being cleaned, and if chips happen to be lodged between the leaf and the body, the operator may not notice them, so that the leaf will be tightened on the



A pin in the clamping screw prevents the jig leaf from being locked if a chip is underneath

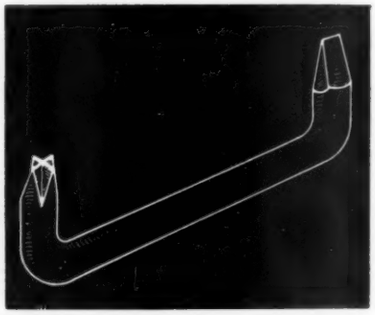
chips instead of contacting its seat.

This trouble can be overcome by drilling a hole in the jig at *A* and fitting the pin *B* in the screw. It is then impossible for the screw to turn backward more than enough to bring the narrow part of its head in line with the slot in the leaf so that the leaf can be raised. If the screw can not be turned when the leaf is closed, it is because of chips or dirt between it and the body, which must be removed before the leaf can be properly seated. When the leaf is properly seated and locked, the pin will be in position *C* and can be seen.

Terminal Stamping Tool

CHARLES H. WILLEY
Supt. of Mfg., Hoyt Electrical Instrument Works

A very handy tool is shown in the sketch. It is a double-end stamp for stamping the positive and negative polarity signs on lead tags and on terminals of electrical equipment. Made from ⅜-in. drill rod and hardened and tempered, it is a convenient addition to the maintenance man's toolkit.



Polarity of the terminals of electrical equipment should be marked for ease in identification

Anchoring Babbitt Linings

A. EYLES
St. Albans, Hertfordshire, England

Rough boring of railroad-car brasses, as described by E. N. Davy (*AM*—Vol. 80, page 775), is only one of several good methods for anchoring babbitt-metal linings. They can be successfully anchored by any of the following methods:

1. Providing suitable dovetailed grooves in the brasses. The grooves are usually cut by machine, although they can be cored. The brasses should also be tinned and preheated before pouring the linings.

2. Peening with a special tool to tighten the lining in the grooves or anchor holes. Peening often improves the babbitt.

3. Spraying the babbitt instead of pouring it. In using this method the brasses should first be sandblasted, but tinning is not necessary as the minute indentations made by the sand blast serve as anchorages. The babbitt in the form of wire is fed into a spray gun which melts the wire and sprays it at high velocity onto the surfaces.

It is very important that babbitt metal be poured at the correct tem-

perature. Although every grade of babbitt has a "best" pouring temperature of its own, the correct heat should be found out from the maker of each grade. Generally speaking, lead-base alloys should be poured at a temperature of 650 F., while genuine babbitt should be poured at temperatures ranging between 700 and 750 F.

In melting babbitt it is very necessary to avoid overheating the metal, as it is apt to cause blowholes, oxidation and other defects. The molten metal should be stirred at frequent intervals and just prior to being poured. Rigorous stirring is desirable, not merely swirling the metal around the side of the pot, but mixing it from the bottom up and in all parts of the pot.

If babbitt is allowed to remain still while in the molten state, it tends to separate into layers. The lead being heaviest gradually falls to the bottom, leaving the lighter ingredients at the top. Linings poured from metal in such a state sooner or later develop trouble in service.

In cases where linings do not adhere tenaciously to the brasses after they have been carefully tinned, the reason is because of one or more of the following conditions:

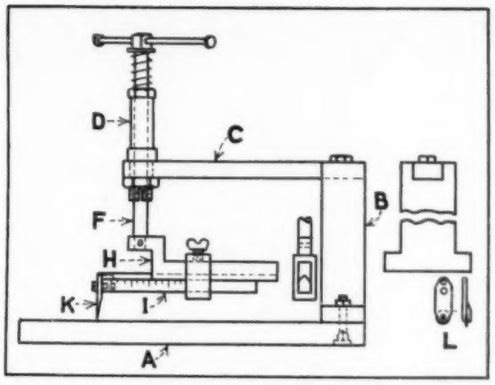
1. The brasses have been overheated and the tin has oxidized.
2. The brasses have not been heated sufficiently to make the tin adhere.
3. The lining is too thick, in which case the babbitt has shrunk away from the brass in cooling. Properly babbitted brasses should ring when struck with a light hammer. If they do not it indicates either that the babbitt has not adhered thoroughly or that the brasses are cracked.

Bench Tool for Cutting Circular Work

H. L. WHEELER

A bench tool for cutting disks, washers and gaskets from various materials is shown in the illustration.

To the hard-maple base *A* is attached the upright *B* carrying the overhanging arm *C*. At the end of arm *C* is mounted the sleeve *D* to serve as a bearing for the spindle *F*. Pinned to the lower end of the spindle is the radius bar *H*, which has a V-groove machined in its under side. The cutter bar *I* is machined to fit the V-groove in bar *F* and is held to it by a yoke clamp. The cutter bar is graduated and to its outer end is attached the cutter *K*. By removing the cutter and attaching the glass cutter *L* in its place, glass crystals for steam and other dial gages can be cut.



This tool will cut washers, disks or round gaskets from various materials

In operation, with the material to be cut tacked or clamped to the wooden base, the spindle is pressed down to bring the cutter into contact with the work and is rotated by the lever at the top of the spindle. In cutting glass, the downward pressure on the spindle should be as light as is possible for the cutter to do its work. The cutter can be set to cut work of any diameter within range of the bar.

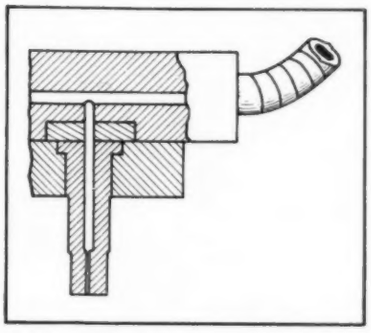
The spring under the lever is strong enough to keep the spindle in its upper position so that the cutter will clear the work when downward pressure is released.

Lubricating Stock in the Punch Press

H. R. HAGEMAN

Various methods are in use for lubricating stock to be operated upon in the punch press. Felt rollers running in oil at the entrance of the stock guide answer the purpose, but are likely to be in the operator's way in starting each strip of stock in the press. Another scheme is to have a very small hole drilled through each punch, as shown in the illustration, and connected with a conduit in the punch-holder, to which oil is supplied through a flexible tube from a reservoir at the back of the press, preferably under pressure. While this method is somewhat elaborate, it is just about perfect for heavy production, as it lubricates the stock at the cutting point.

A simple and effective method is to mount at the right-hand side of the press a small tank such as is furnished with milling machines. Such a tank has a pet cock and an adjustable spout by which a thin stream of oil can be directed on the stock close to the entrance of the stock guide. A trough and a pan of sheet metal can easily be arranged to catch the surplus oil, thus accomplishing the job with a minimum of waste.



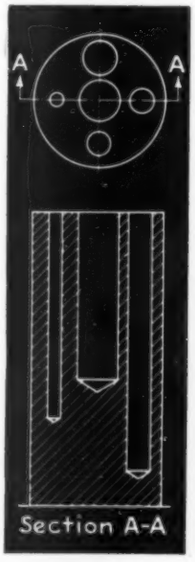
Oil is delivered through a hole in the punch to lubricate the stock

Gage for Setting Drills in Multi-Spindle Head

F. MUIR
Hamilton, Ontario, Canada

In jig-drilling blind holes of different diameters and depths in a multi-spindle drill press, it is necessary to set each drill so that it will project the correct distance from the chuck, and to set the depth stop.

To save time in setting the drills



With the drills set by this gage, blind holes can be drilled to the correct depth without the chance of error usual to measurement

and adjusting the depth stop, the setting gage illustrated was made. It is simply a piece of round steel cut to the same length as the distance from the bottom of the jig base to the top of the work. In this piece, blind holes of the correct diameter and depth were drilled.

In use, each time the job is to be started, the gage is placed under one of the spindles and the drill for the deepest hole, loose in the chuck, is allowed to touch the bottom of its hole. The chuck is then tightened on the drill and the depth stop is set. The other drills are set in the same way without disturbing the adjustment of the depth stop. Thus, the drills can be quickly and accurately set for the correct depth.

Cam-Controlled Tool Cuts "Wabble" Oil Grooves

IRA S. WILLIAMS

The guide rollers for the film in moving picture equipment must revolve with the passing of the film without slippage, especially where the emulsion side of the film is in contact with them. To reduce friction by lessening the bearing area and to distribute the oil, so-called "wabble" grooves are cut in the journals.

Two grooves are cut at a time by the cam-controlled tool *A*, the work being done in a bench lathe from which the leadscrew has been removed. The cam *B* is attached to the faceplate and the cam roller *C* is kept in contact with the cam by the spring *D*, the movable part of the container of which bears against the tailstock. Since the stationary part of the spring container and the support for the cam roller are both attached to the carriage, the carriage is moved in one direction by the cam and in the opposite direction by the spring, causing the tool to follow the path of the cam and cut the grooves.

Variable Bushing Driver

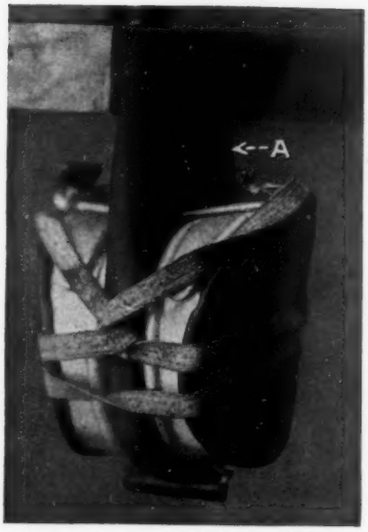
W. M. HALLIDAY
Peterborough, Northants, England

In bushing holes it is sometimes necessary to have the ends of the bushings flush with or projecting above the surface of the work. Where quantities of such installations are to be made, the device illustrated will enable the user to regulate the amount the bushing will be driven.

The body *A* of the device is reduced at one end to form a shank to take the hammer blows, while the opposite end is drilled and tapped to receive the pilot *B*. The body is externally threaded to receive the threaded sleeve *C*, the outside of which is knurled for a good grip. The clamping screw *D* holds the sleeve in adjustment on the body and seats on a soft metal disk to protect the threads on the body.

The diameter of the detachable pilot *B* is the same as that of the hole in the bushing to be driven. It is provided with two flats to permit the use of a wrench in screwing it in or out of place.

Where a bushing is required to be flush with the surface of the work, the sleeve is screwed back on the body until its face *F* is clear of the end *H* of the body. The bushing is then driven in until the end of the body contacts the work. Where the bushing is required to project above the surface of the work, as shown in the small view at the lower left, the sleeve is screwed to the left on the body until its face *F* overlaps face *H* of the body by the amount necessary.



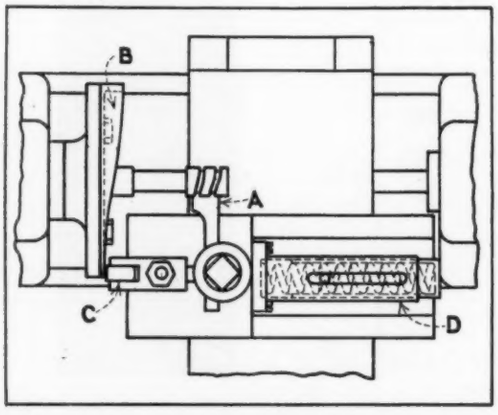
The goggles are folded around a rubber inside heel-pad attached to the edge of a shelf and are held in place by the elastic head-band

Handy Holder for Safety Goggles

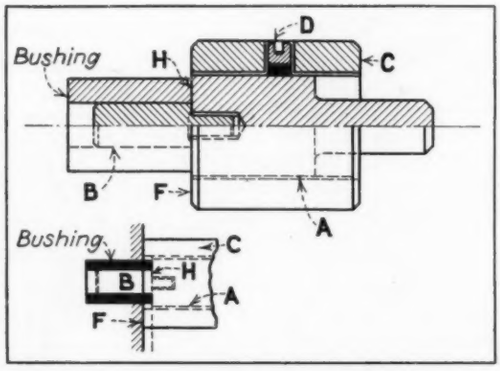
FRANK BENTLEY
Chicago & Northwestern R. R., Clinton, Iowa, Shop

The cardboard box in which safety goggles are packed by the maker does not last long about the bench or in the drawer. When hung on a nail or a hook by the flexible nosepiece, the glasses are often nicked or marred.

A very neat and practical holder for goggles having a flexible nosepiece is shown in the illustration. An ordinary rubber inside heel-pad *A* is tacked to the front edge of a shelf or to a cleat on the underside of the shelf. The goggles are folded around it so that the outsides of the glasses are in contact with the soft rubber and are held in place by snapping the elastic head-band around the pad and into the concave frame.



The carriage is moved in one direction by a cam attached to the faceplate and in the opposite direction by a spring bearing against the tailstock



With this tool, bushings can be driven flush with or projecting above the surface of the work, depending upon the position of the sleeve C

Apprenticeship Days

CHARLES WESLOW

III—Give an apprentice good work to do, then if you want him to do some dirty work it will be done quickly

IN SIX MONTHS' time Joe, the colored boy apprentice, added eight more inches to his height. Now he could reach up to where Spencer used to hide his "Grandpa's Wonder Soap." That was a brown mixture in a solid cake, known in those days to take off dirt better than anything else. The rest of us couldn't afford a dime for such a luxury, but Spencer always went for the latest things. His tool box, the size of a steamer trunk, was full of good tools and he sure knew how to use them.

Spencer, Joe and I had to work together on part of Mr. Madden's machine; Joe doing the small lathe work, while my work with Spencer was clamping parts together and drilling holes for screws and dowels with what was then known as a "Yankee fiddle." This was a breast drill with back gears. Spencer would rig it up with props and a jack screw so we didn't have to push on it too hard.

I saw Spencer show Joe how to caliper a four-inch hole with a pair of Starrett calipers having an adjusting screw on the side. When I saw those calipers I began saving up to buy a pair like them. I also bought a similar pair of hermaphrodites. I have them yet and have always used them in holes ranging from 1 in. up to 4 and 5 in. They are not on the market any more and I wouldn't sell mine for ten bucks.

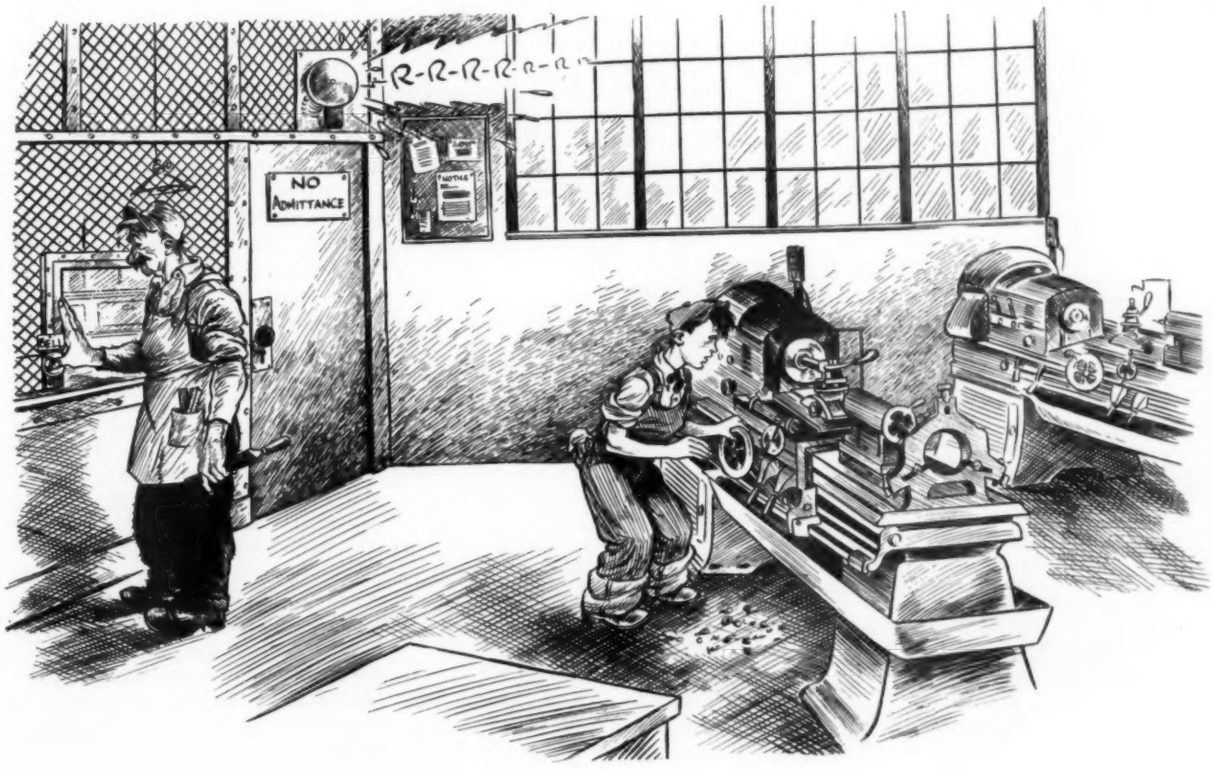
During my apprenticeship, boys were not required to repair machinery; this was done by a skilled machinist. What we did do most willingly on our own time was to clean up second-hand jewelers' machinery. We cleaned willingly because the dirt and filth on the machines would yield enough precious metals to amplify the allowance our parents provided. Soon as we had a gallon of such "dirt" saved up the firm would take it to the refiner. Eventually it came back to us in the form of cash.

Keeping an apprentice doing dirty work makes him wonder when he is going to learn the trade. Give him skilled work to do, and he will eat out of your hand; then if you happen to want him for a little dirty work he will gladly do it in a jiffy, knowing all the while that he will soon be back learning.

Mac, our foreman, recently gave me a job making two "built up" jigs on which there was a lot of lathe work an apprentice could do. I induced him to loan me Teddy, the tool crib boy, and placed him on a 14-in. lathe some 25 ft. away from the crib. Teddy didn't like the idea of stopping the lathe every time some one wanted something out of the crib, but I told him that I would teach him the same way my foreman taught me. Believe it or not, Teddy was soon running to the crib and back again.

Teddy had some pieces clamped on

Teddy didn't like the idea of stopping the lathe every time someone wanted a tool from the crib



the lathe face-plate that had to have a tapered hole bored, as shown in the sketch. I showed him how to set the compound slide rest accurately to within a quarter of a degree. In the sketch it will be seen that the work is separated from the face-plate by ¼-in. cold-rolled blocks. Since there are slots in the face-plate, there is room for a small C-clamp to hold a bevel gage which has been previously set to a protector.

It is obvious that when an indicator is fastened in the tool post the slide rest can be adjusted according to the reading on the indicator. There are graduations in degrees marked or stamped on the side of the compound rest, but these graduations are not accurate and must never be depended on for anything but rough work.

The smallest diameter of the hole was to be bored out to within one thousandth before boring the taper, so I had Teddy bore it out to within one ten thousandth; just to take advantage of the opportunity to give him some practice in measuring with a vernier. It took Teddy almost a half hour to master the "feel" of the measuring instrument, but it was time well spent because thereafter he could measure a hole in a couple of minutes. He then coated the surface of the hole with copper sulphate and proceeded to indicate the correct angle according to the bevel gage. Then he bored out the angular hole, taking cuts until no more copper was visible in the hole. I loaned him my three-cornered scraper, after showing him how to scrape out a hole smooth without chattering. After this a piece of medium emery cloth finished the hole satisfactorily for the use to which it was to be put.

We had no such tool as an indicator when I was an apprentice. Bart showed me how to hold a turning tool in the tool post and keep the cutting edge up close to the bevel gage, using a piece of newspaper as a feeler between the turning tool and bevel gage.

When the time came for Teddy to lay out a number of ⅜ in. holes on the two round plates, he found that the holes had to be reamed so a standard size piece of drill rod would fit tight in the holes. Fastening the plates onto the dividing head was easy for Teddy; then all he had to do was disengage the gears in the dividing head, so the spindle would revolve easily by hand, and mark off proper layout with the scriber on a height gage.

Locating Intersections

When it came to prick punching the intersections, he would have socked the biggest punch he could find into the plates if he'd had his way. I showed him how to use a blunt pointed scriber first, pressing it into the intersections by hand. Learning how to place the point of the scriber into a scratch and then slide it along until it fell into the intersecting scratch, when he then gave it a vertical push by hand, led him to believe he was learning to be a toolmaker. His next move was to use my fine prick punch, only $\frac{1}{32}$ in. diameter at the punch end, to enlarge the punch mark left by the scriber; forcing it in gently with a light hammer. "You must," I told him, "see that such a fine prick-punch is round and sharp at the point." Next he used a prick punch ⅛ in. diameter at the punch end, hitting it with the same light hammer.

He was then all set to drill. His first drill was a No. 52, which was used to a depth of ⅛ in. This was followed by a center reamer which left a $\frac{3}{16}$-in. spot.

His next move was to run a $\frac{3}{16}$-in. drill into those spots to ¼-in. depth. Then he fished out my ⅜-in. spotting counterbore, having a $\frac{3}{16}$-in. pilot, ⅛ in. long. All he did with this was to open up the spot. The angle of this counterbore was the same as that on the ¼-in. drill he used next, right through the plate. This hole led the way for my undersize ⅜-in. counterbore, having a ¼-in. pilot. This he used all the way through, leaving the holes five thousandths less than ⅜ in. His next and last move was to use my ⅜-in. reamer that leaves a hole in machine steel a half thousandth under ⅜ in., if oil is squirted onto the reamer. With my three-cornered scraper he carved the sharp corners off both ends of each of the holes.

When Teddy had all the holes drilled and reamed in the cold-rolled plates I had him set the plates up again on the dividing head and indicate so as to check up the holes. He made a short piece of ⅜-in. drill rod that fitted snug into the holes and with an indicator on the height gage he found that the holes were within two thousandths, which was two thousandths too good for the job.

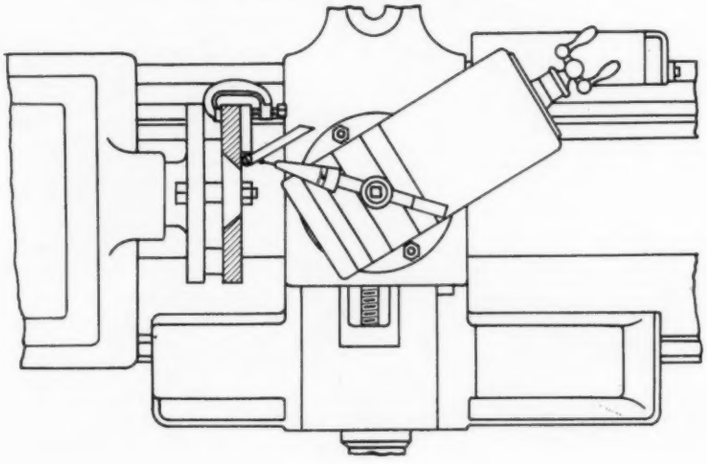
Drill Rod Bushings

Next Teddy made the drill bushings for those ⅜-in. holes. He made a centering tool bit like mine and set to work making the bushings in the bench lathe. First he centered for a $\frac{3}{16}$-in. drill, then ran a No. 17 drill through each blank. Following it, he used a No. 15 drill; this was followed with a $\frac{3}{16}$-in. machine reamer.

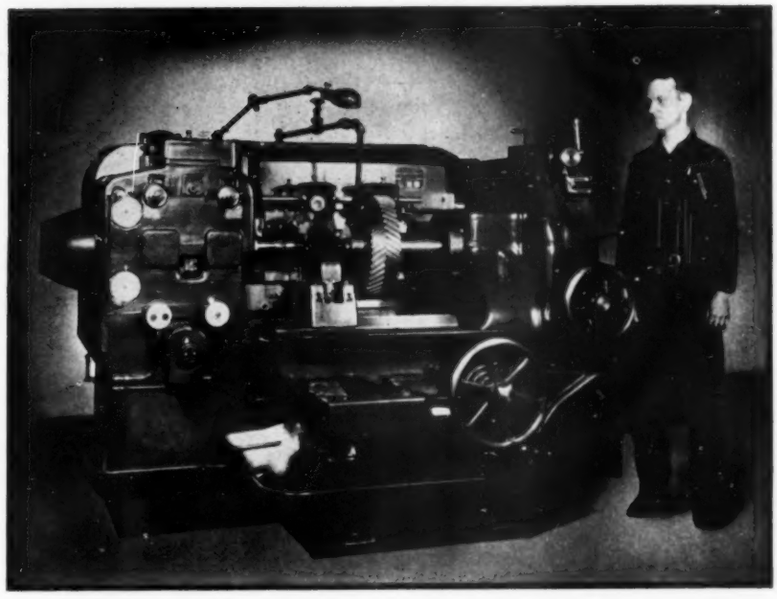
After all the bushings were reamed, he chamfered one edge of each hole for the drills to enter and took them to the furnace. He found that when he heated them to a very dull red they, being drill rod material, came out good and hard. He also found that the outside diameter enlarged from a half to one thousandth of an inch, which made a good fit in the reamed holes in the plates.

Sometimes, when Teddy was helping me, the tool crib bell would ring like the chimes of Trinity Church. Teddy was too absorbed in the work to give that pesky bell much consideration. Someone complained to Mac about it and he came to me for information. I suggested that he place a robot in the crib, instead of a boy who was anxious to learn the trade.

Accurate setting of the compound slide can be accomplished with this arrangement



Shop Equipment News



No. 2-C Farrel-Sykes gear generator is automatic except for loading and removing the work

Farrel-Sykes No. 2-C Gear Generating Machine

Model No. 2-C Farrel-Sykes gear generating machine, announced by the Farrel-Birmingham Co., Inc., 344 Vulcan St., Buffalo, N. Y., has capacity for gears ranging from ¼ to 25 in. in diameter and up to 8-in. face width. It will cut gears having a maximum pitch of 3 D.P. helical and 2¼ D.P. straight teeth, and a minimum pitch of 24 D.P. Like other Sykes gear generators, this machine operates on the gear shaper principle, using circular gear-form cutters. It is equally suitable for toolroom work, for general jobbing work, or for line production and it will cut every type of gear used for connecting parallel axes.

This machine has been used for such operations as cutting two members of a cluster gear simultaneously, machining cylindrical surfaces on shafts and pistons, cutting spline shafts, and cutting some forms of cams. A further development is the cutting of a large quantity of gears, mounted in a gang, by means of several cutters working simultaneously.

Speed and feed controls have been brought to the front of the machine, and the speed and feed change-gear box is in one unit. The slideways on the bed of the machine are covered in such a way that grit and dirt is prevented from getting into the sliding surfaces.

The helical guides are of a new double-groove type and the moving members and fixed members are approximately the same length. The cutter heads, which embody the release mechanism, are of unusual design. Release of the cutters is positive and when the cut is being taken the mechanism carrying the cutter is firmly locked with the cutter head. An improved infeed mechanism is fitted to the machine so that it is entirely automatic except for mounting the work and taking it off after it is finished. The large face-width capacity, together with the 3½ in. diameter hole in the main spindle, and the rigid outer work support, make the machine suitable for cutting gears or pinions integral with shafts, or when mounted on long sleeves, and for a variety of special work. The outer work support has a large range of adjustment and it can also be used for carrying special quick-acting work fixtures.

For machining smooth peripheries, plain disk-cutters are used, and the result is a finely finished cylindrical surface produced at low cost. Weight of the machine is 13,900 lb., and floor space occupied is 111x87 in. A 5-hp. motor is used for the main drive and the coolant pump requires a ½-hp. motor. Eight speeds are available

when the machine is fitted with a two-speed a.c. motor; when a d.c. variable-speed motor is used the number of speeds is variable from 86 to 400 r.p.m. of the crank. Four cutting feeds are provided. Maximum and minimum rates of feed may be changed to anything desired by means of separate pick-off gears.

Westinghouse 400-Watt Aluminum Reflectors

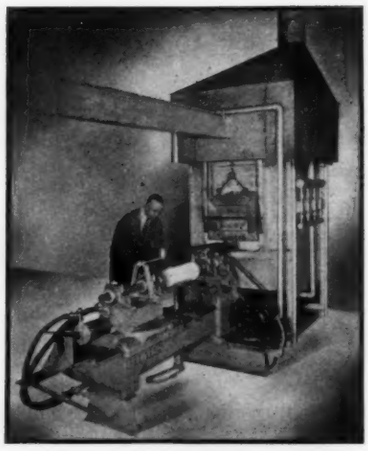
Aluminum reflectors designed properly to distribute light from 400-watt high-intensity mercury lamps have been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These units are particularly suited for general lighting where the mounting height is 18 ft. and over. A Mogul type socket is mounted in the hood.

"Xaloy" Hard Surfacing

"Xaloy", a hard-facing alloy, announced by Wilcox-Rich Division, Eaton Manufacturing Co., Detroit, Mich., is suitable for applications where its high-hardness and resistance to abrasion can be used to advantage and where high impact values and ductility are not important. It has a tensile strength of 43,000 lb. per sq.in., and compression strength of 240,000 lb. per sq.in. Its hardness is equivalent to 750 Brinell or 68 to 70 Rockwell C.

A method of centrifugal casting has been perfected wherein "Xaloy" is applied in a molten state to the outside or inside diameter of bushings or other tubular pieces that are to be subjected to abrasive wear. A perfect fusion bond is obtained. The coating of Xaloy has uniform surface hardness and uniform thickness. Thickness of the wall is controlled to very close limits to reduce to a minimum the finishing operations, for which special honing and grinding equipment is required. The resulting surface is mirror-like and has an extremely low coefficient of friction.

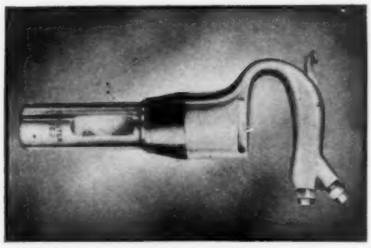
It has been found that the life of



tool bushings is lengthened considerably when they are lined with Xaloy. Good results have also been obtained by using this alloy as an internal liner for honing control-bushings, which have a continuous wiping-wear on the inside diameter that is increased by the presence of abrasive compound.

Master Pneumatic Chipping Hammer

The "Master" chipping hammer, announced by the Master Tool Company, Inc., 5605 Herman Ave., N.W., Cleveland, Ohio, features a "lifetime" valve block that, it is claimed, will last the life of the tool. Another



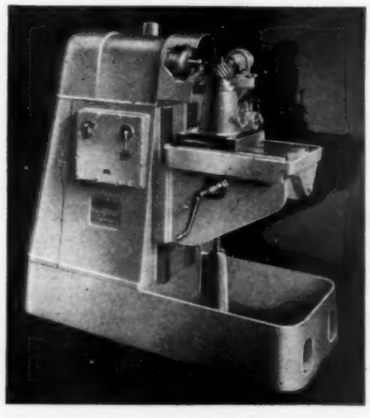
feature of this hammer is a chrome-plated cylinder. A locking device prevents the handle from working loose and an extra bushing in the handle receives the air inlet bushing and protects the threads in the handle proper.

Cross Gear Finishing Machines

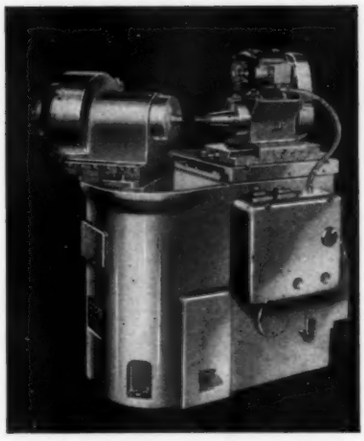
Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich., has recently announced improvements in and additions to their line of rounding, pointing, chamfering and burring machines for gear tooth finishing. The No. 35 gear tooth rounder has been improved by the use of a new type hydraulic-control system. Where previous models had a full-hydraulic circuit, new models have a hydraulically actuated mechanism in which the hydraulic valves are electrically controlled. This change gives more instantaneous and precise control of all functions of the machine, reduces operating expense and permits complete inclosure of all hydraulic mechanisms.

This gear rounder has capacity for gears up to 34-in. diameter by 15-in. face. Speeds and feeds are easily controlled by the operator and up to 140 teeth can be cut per min. Power from the 3-hp. 1,800 r.p.m. drive motor is transmitted through V-belts. The machine occupies 32x60 in. floor space and weighs approximately 3,200 lb.

The Model 40 single-spindle gear-tooth pointing machine is controlled by electric pushbutton and pedal, leaving both of the operator's hands free for loading purposes. This unit has capacity for gears up to 20 in. diameter and 10 in. face, and will cut 2 pitch or finer. Gears with from 8 to 150 teeth can be indexed with the standard range, other ranges are available. Up to 150 teeth can be pointed per minute. Special cutter heads can be furnished for work beyond the capacity of the standard machine. A 1-hp., 1,800 r.p.m. motor is mounted on the spindle head and the main drive requires a 2-hp. 1,200 r.p.m. motor. Net weight is approximately 3,200 lb. and the machine occupies a floor space of 65x45 in. The No. 41 machine is similar in all re-



No. 35 Cross gear tooth rounder has a hydraulic-control system in which the valves are electrically actuated

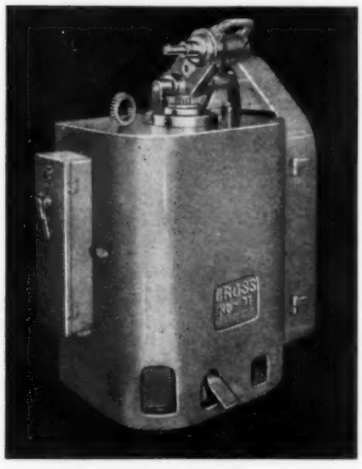


No. 40 Cross gear tooth pointer may be tooled up for internal and external tooth chamfering operations on spur or helical gears

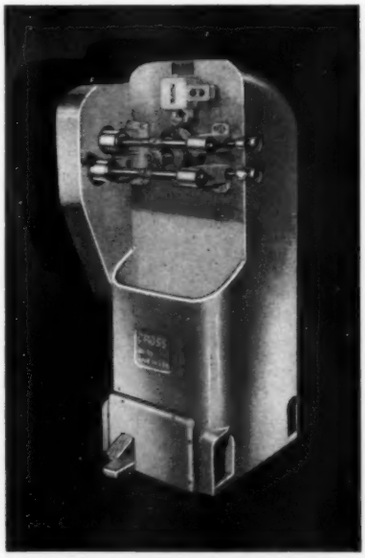
spects to the single spindle machine, except that it consists of the equivalent of two machines mounted on a single base. Each spindle of this two-spindle machine is entirely independent of the other, both in control and operation.

Cross gear tooth burring machines function on the "continuous cutting" principle and there is no time lost in indexing because the work and cutters rotate in timed relation at a constant speed. An automatic stop shuts the machine down upon completion of one full cutting cycle. Work-holding tools are actuated by an air-clamping mechanism controlled by pedal, which leaves both hands of the operator free for loading. Cutters may be individually adjusted as needed to remove more or less material. The No. 70 machine is fully automatic and will remove burrs and sharp edges from external spur and helical gear teeth, straight and spiral bevel gear and pinion teeth, and external straight and helical splines. The average automobile transmission gear with helical teeth is burred and chamfered on both sides of the teeth at the same time at a rate of approximately 240 gears per hour at 80 per cent efficiency.

No. 71 gear-tooth burring machine has a vertical spindle and is designed for internal operation. The cutter-head is counterbalanced to stay in the "up" position when not held down by the operator. The machine starts automatically when the cutter head is moved downward and stops automatically when the cutter head is returned to the "up" position.



A micrometer adjustment accurately positions the cutter of the No. 71 Cross gear tooth burring machine



Two cutters are used on the No. 70 tooth burring machine to remove burrs and sharp edges from both ends of the teeth at the same time

New York Asbestos Steam Hose

The "Great Seal Asbestos Cord" steam hose, announced by New York Belting & Packing Co., 1 Market St., Passaic, N. J., is made with four asbestos cord plies wound spirally in alternating directions around a steam- and heat-resisting tube. The asbestos cords will not char under high temperatures and the heat-resisting cover is specially compounded for this type of service. It can be furnished with a special non-static feature. This hose comes in ½, ¾, 1, 1¼ and 1½ in. inside diameter sizes and will accommodate pressures ranging from 175 to 200 lb., depending on the size.

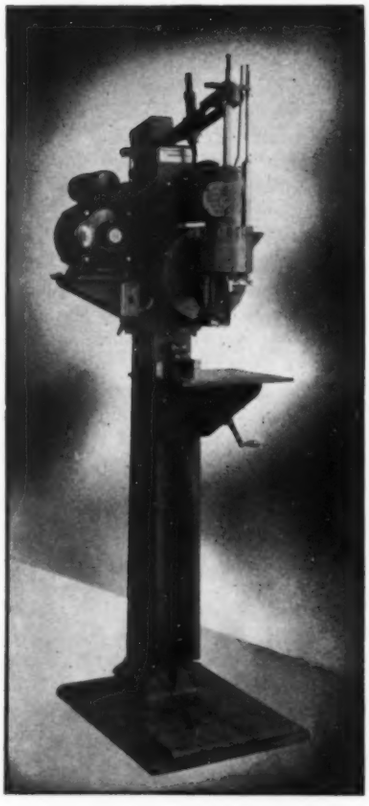
B.&S. No. 2 Vertical Miller

In the recent description of the No. 2 vertical milling machine offered by Browne & Sharpe Mfg. Co., Providence, R. I., (*AM*—Vol. 81. page 140), the spindle speed range was given as 55 to 800 r.p.m. Obviously, this is an error as this machine is featured for using small cutters run at relatively high speed. The correct spindle speed range for this machine is 55 to 1,800 r.p.m. and power feeds range from ½ to 18¼ in. per min.

Akron Full-Automatic Screw-Driving Machine

The full automatic screw-driving machine announced by Akron Automatic Machine Co., 100 Beech St., Akron, Ohio, will handle any size or type of machine or wood screw without major changes. It is also adaptable to driving nuts on stud bolts or bolts already in position. With an extra magazine and track it will assemble nuts and bolts through small parts.

The magazine is rubber lined to eliminate marring or discoloring screw heads and is completely universal, handling screws, bolts or nuts. The screw track is adjustable sidewise for



thickness of screws and the track cover is adjustable vertically for the thickness of the heads of screws. Diameter of the screw head makes no difference in the magazine or track as long as it is larger than the diameter of the screw.

Jaws and screw driver tips are different for different types of screws. If it is desired to drive screws having different types of head with the same machine, it is necessary to have different sets of jaws and screw driver tips. These are inexpensive and can be changed in less than five minutes. For handling nuts an entirely different type of track is necessary, and usually a different track is required for each size of nut. A socket wrench is used in place of the screw driver tip for driving nuts.

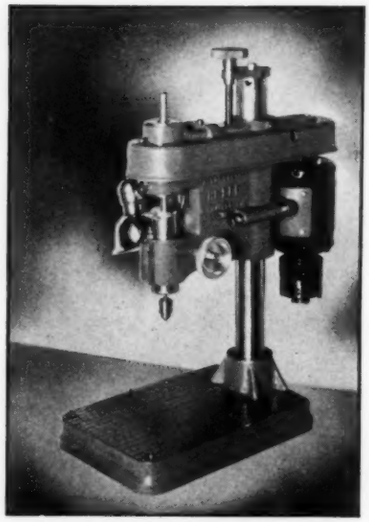
Stroke of the screw-driving spindle is wholly automatic, the downward stroke being started by releasing the main clutch. Cycle consists of a downward motion, very rapid for a distance of 4 in., then slow for another ½ in. for driving the screws, after which the return to the starting point is at high speed. For driving screws which require driving more than ½ in. thread, provision is made for a spring at the top of the machine to be compressed, allowing driving the extra thread. The cycle is timed for 43 strokes per min.

The long vertical travel is designed to permit driving screws into deep recesses and the jaws and chucks are designed so the screw may be driven in the bottom of a 3½ in. deep cut having a minimum clearance. In some cases the hole may be as small as 1 in. diameter. It is possible to drive the screw with the head touching the face of a vertical wall as high as 4 in.

Tightness to which screws are driven is controlled by a multiple-disk friction clutch which is quickly adjustable from the top of the spindle. It is possible to arrange the machine to stop screws at any desired depth in the work. Specifications: height over all 6 ft. 6 in.; depth of throat, 11¼ in.; length of stroke, 4½ in.; motor size, ½ to 1½ hp.

Taylor "HI-EFF" Sensitive Drill Press

Designed to meet the demand for a suitable machine for producing very small holes, the "HI-EFF" sensitive bench-type drill press offered by Taylor Manufacturing Corp., 2330 West Clybourn St., Milwaukee, Wis., is a smooth running unit with spring-cushioned motor drive. The light-



weight, counterbalanced, ball-bearing spindle is designed to allow the operator to feel a 0.002 in. diameter drill cut away the material.

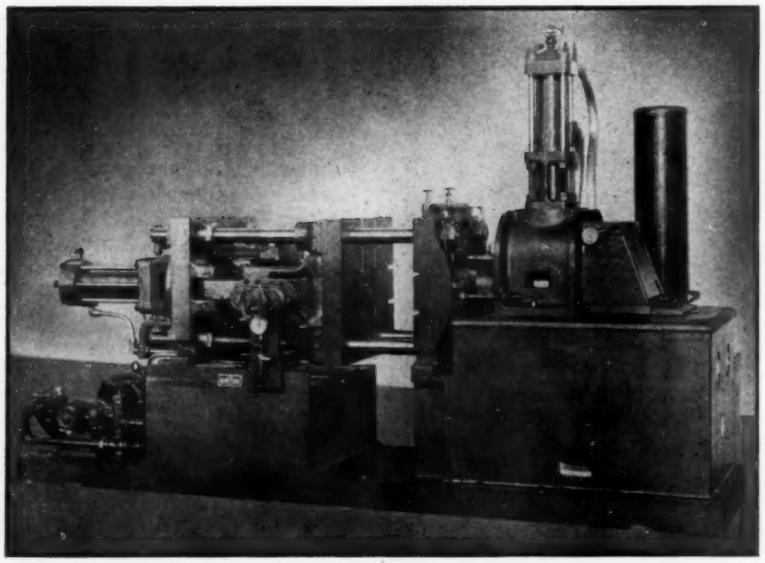
Six models are available with capacities for drills from 0.002 in. to ¼ in. diameter, and with a maximum run-out of spindle and chuck guaranteed to be not more than 0.0001 in. for the A-102 model, to 0.003 in. for the A-112 model. Four of the six models have a speed range from 800 to 10,000 r.p.m., varying by 100 r.p.m. Other speeds up to 40,000 r.p.m. can be furnished on request. The two production models have a V-belt drive with speeds of 1,500, 3,500, 5,500 and 7,500 r.p.m.

Travel of spindle for supersensitive models is 2⅛ in., for the production models it is 3 in.; maximum distance from chuck face to table is 10 in. and the machines will drill to the center of a 16 in. diameter circle. Each model has an over-all height of 22½ in. and a weight of 90 lb. Travel of head is 10 in., working surface of the table is 9x10 in., and bench space required is 10x20 in. Drive is by a ¼ hp., 110 or 220 volt, single-phase motor.

Reed-Prentice No. 1½ Die-Casting Machine

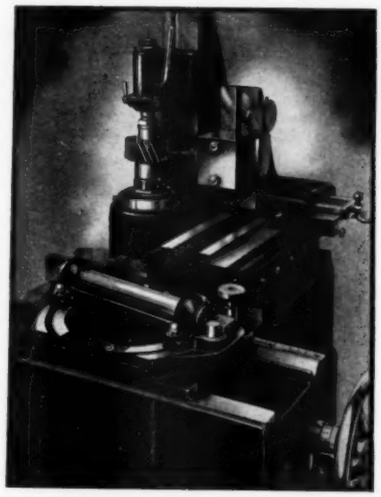
The No. 1½ zinc die-casting machines announced by Reed-Prentice Corp., Worcester, Mass., are fully hydraulic. Two levers control the operation of the machine and these are interlocked so that it is impossible to operate the plunger cylinder until the dies are securely locked. A safety pilot valve mechanism eliminates danger of shooting the metal when the dies are open. Dies provide for automatic ejection of castings. Die plates are finished on all four sides to provide for core pulling attachments.

Die plates are approximately 28 x 29 in. and the space between bars is 18 x 18 in. The die opens 10 in., maximum die space is 18 in., and minimum die space is 6 in. The dies can be closed in 1½ sec. and it is estimated that 400 shots can be made per hour. The melting pot has a capacity of 700 lb. of zinc and a 5-hp. motor drives the hydraulic pump. Weight is 14,000 lb.



Michigan Gear Checking Equipment

Michigan Tool Co., 7171 E. McNochols, Road, Detroit, Mich., is now offering a complete line of gear checking equipment. In addition to the gear speeder announced some time ago, the line now includes a combined tooth form and tooth spacing checker, a spiral lead checker, and a hob contour and worm lead testing fixture. A sine bar is used in every piece of equipment, either for setting the machine, to produce a ratio of movement between two moving parts, or



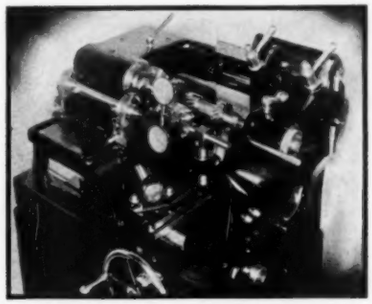
The Michigan combined involute and tooth spacing checker is readily adapted to taking charts for comparison. It requires no master forms or disks

to control the movement without the use of a leadscrew.

The combined involute and tooth spacing checker requires no master forms or master base circle disks. The sine bar on these machines acts as a compensator for the differences between the lengths of arc on the friction disk, which originates the machine movements on the base circle of the gear being checked. The friction disk is integral with the work-holding spindle and imparts movement to the sine bar carriage. Angular setting of the sine bar controls the movement of the indicator head, which is counterweighted to hold it against the sine bar. The smaller the gear being checked the smaller the angular setting of the sine bar. Each degree of work rotation may be read on a scale alongside the sine bar carriage.

The use of two indicators and a reversible finger for tooth form makes possible the reading of tooth form on front and back faces in the same setup. Gears up to 12 in. diameter by 12 in. long can be checked on this machine.

On the spiral lead checker, spiral lead is checked in preference to the helix angle for the reason that the lead is constant no matter at what depth or portion of the tooth the



Spiral lead is checked on the Michigan spiral lead checker in preference to the helix angle because the lead is constant no matter at what depth the measurement is taken

measurement is taken, while the specified helix angle is correct only at one diameter and varies with the depth at which the measurement is taken.

The spiral lead checker takes gears up to 16 in. diameter with leads of 6 in. or over for either right- or left-hand spirals. On this machine the sine bar is set to correspond to the correct spiral lead by means of two measuring buttons. The sine bar carriage and the indicator are moved by the hand wheel parallel to the axis of the gear. A clevis straddling the sine bar moves the upper carriage at right angles to the sine bar carriage. The work-holding spindle is revolved by friction of two lapped blocks on rolls. In this way indicator movement and gear rotation are synchronized during checking.

"Progressive" Portable Spot-Welding Gun

The portable, hydraulic, automatic spot-welding gun offered by Progressive Welder Co., 737 Piquette Ave., Detroit, Mich., is a production unit designed for assembling sheet metal parts. Hydraulic operation makes possible a small, light and compact welding gun, delicate working parts being eliminated from the design of the unit.

The hydraulic booster is capable of pressures ranging from 0 to 3,000 lb. Finger-tip control for varying this pressure is provided on the gun and insures correct pressure for all working conditions. Water-cooled transformers of either 50 or 75 kva. capacity are designed to withstand overloads and are practically short-proof. A simple hand-operated switch varies the transformer output to suit different gages of material and different welding conditions.

Timing devices control electric current input, and once the controls are set for a given set of conditions, the automatic equipment leaves nothing to chance.

Three types of guns are available and a wide variety of points, adaptors, and yokes are designed to accommodate almost any shape or section. The pincher, expansion, and fixture bar type hand guns cover every field of operation. The units are light enough to be used without a balancer and they can be handled in small spaces without strain on the operator.

Mathews Heavy-Duty Conveyor Rollers

Two ball-bearing, heavy-duty rollers for roller conveyors have been announced by Mathews Conveyor Co., Ellwood City, Pa. Designs incorporate self-contained double seals which protect the ball bearings and

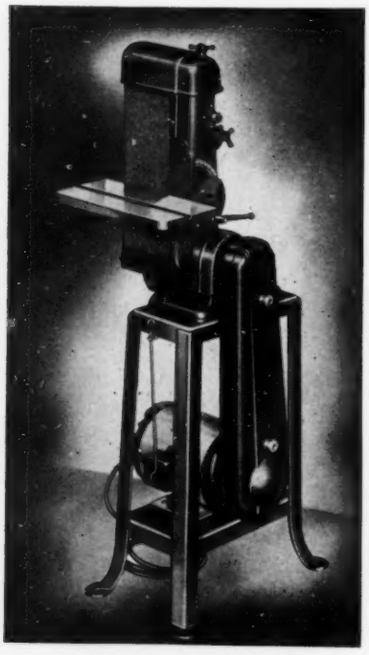
race-ways from foreign matter. Both types have hexagon axles, thus preventing the inner ball race-way from rotating on the axle, which is held stationary in the conveyor frame.

Type 63SB roller is available in 4, 4¼ and 4½ in. diameters and in standard lengths from 6 to 48 in. These rollers can be spaced, center to center, from 6 in. up to suit specific requirements. Industrial grease fittings are used to provide a means of periodical lubrication. Load ratings vary with the diameters from 3,000 lb. for the 4 in. roller to 5,000 lb. for the 4½ in. diameter roller when used in level lines.

The Type 105SB roller design includes similer features and is available in 5 in. diameter with lengths to suit requirements. This roller is applicable to both power driven and gravity conveyors and each roller has a continuous rating of 8,000 lb. per roller.

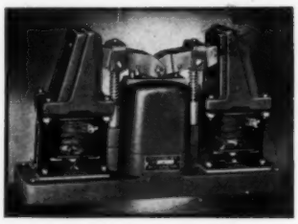
Delta 6-In. Surfacer

The completely inclosed 6-in. belt surfacer marketed by the Delta Manufacturing Co., 620 E. Vienna Ave., Milwaukee, Wis., is designed to handle a wide range of sanding, surfacing and finishing operations. It can be used either as a horizontal or vertical sanding machine. When in the horizontal position it may be fitted with a fence and an adjustable back stop to guide and stop the work. A tilting table can be used when the machine is in a vertical position; this table permits a wide variety of angular shaping and sanding. Drums carrying the sanding and finishing belts are designed to eliminate the necessity of rubber coverings, which require frequent replacement. Every part of the belt and drive mechanism is completely inclosed, this makes the machine conform to safety requirements and enables the use of an efficient dust-collecting system.



Hunt "Quick-As-Wink" Six-Way Control Valve

No. 1496, double-solenoid air control valve, manufactured by C. B. Hunt & Son, Salem, Ohio, can be operated as a six-way valve or as a double three-way valve. When used in the latter manner it affords economies over two similar three-way



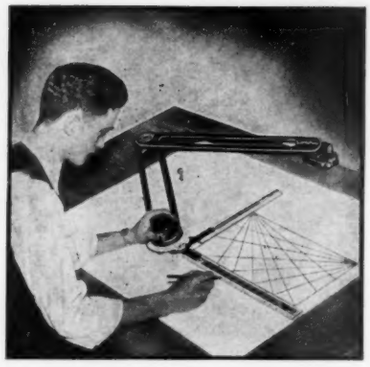
valves. The valve may also be used as a four-way, compound exhaust valve. It is made in ⅜, ½ and ¾ in. sizes.

The solenoids in this valve operate independently, each having a separate return spring. In all of the possible combinations this valve is normally closed. It can be supplied for normally open operation if required. Valve cage or solenoids may be removed for inspection without disturbing the piping.

K & E "Paragon" Drafting Machine

The "Paragon" drafting machine, anounced by Keuffel & Esser Co., Adams & Third St., Hoboken, N. J., can be controlled entirely by the left hand. The machine consists of a jointed arm of aluminum alloy, having a protractor head fitted with two scales at 90 deg. Parallel motion is maintained by tempered steel bands, under constant tension, which are concealed within the arm sections. All moving parts turn on precision ball bearings for uniformity of operation.

The protractor head allows the scales to be set and locked at any angle, to move freely in angular displacement, or to stop automatically at every 15 deg. Variations of the scale angle are made by means of a locking and stop mechanism operated by a lever under the left thumb of the operator.



Two models of the "Paragon" drafting machine are available. The standard type, with a spring counterbalance to prevent accidental motion, is designed for use on drawing boards at any angle up to 15 deg. The vertical type unit has a weighted counterbalance and can be used in any position from horizontal to vertical.

Fostoria Short-Coupled Lamps

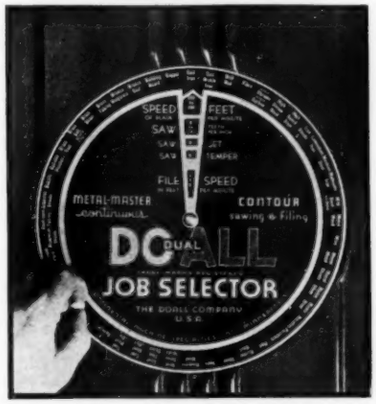
Designed for use where space for attachment is limited, the short-coupled localized lighting units, announced by The Fostoria Pressed Steel Corp., Fostoria, Ohio, are available in two sizes. The difference between these two units is in size of reflector only. As in the case of all

Fostoria lamp units, the reflector is permanently joined to the socket holder which prevents the socket from pulling apart.

The No. 12 unit, shown, is 12½ in. long over-all. This unit will accommodate up to a 60-watt bulb. No. 12C unit is 11½ in. long and is equipped with a shade assembly which accommodates 15 and 25 watt bulbs. Both units are attached to a stamped base which has two holes for mounting the unit in the desired position on the machine or bench.

Doall Job Selector

The "Job Selector Dial" is a feature of the Doall contour machine offered by Continental Machine Specialties, Inc., 1301 Washington Ave., South, Minneapolis, Minn. This control dial is mounted on the hinged door covering the upper wheel. It lists 48 different materials in alpha-



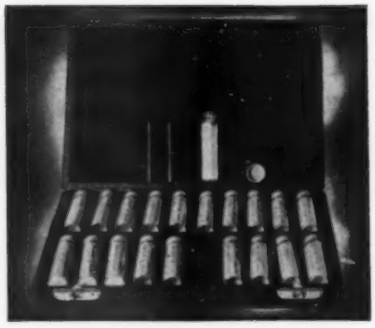
The "Job Selector" dial lists saw data for 48 materials, from aluminum to zinc

betical order around the rim of the dial, beginning with aluminum and ending with zinc. As one of the important factors in narrow-band, contour sawing is the correct speed of the saw for each material and each thickness of job, this dial will be of much value to the machine operator. In addition to showing the correct sawing and filing speed, this control also indicates the correct saw to use. That is, it indicates the correct selection of saw as to "pitch", "temper", and "set" for each of the 48 different materials.

Van Keuren Gear Measuring Wires

The Van Keuren Co., 12 Copeland St., Watertown, Boston, Mass., is offering a set of gear wires which are suitable for measuring the pitch diameter of either 14½ or 20 deg. involute gears of any number of teeth from 9 to 200. This system of gear wires, which greatly simplifies calculation, is based on formulae given by Buckingham in his book "Spur Gears".

The system involves the use of a series of wires which are inversely proportional to the diametrical pitch, tooth factors for each different number of teeth from 9 to 200 and values of Cos $90/N$ for use in measuring gears with odd numbers of teeth. Complete formulae and tables showing how to make pitch diameter measurements are furnished the set of wires.

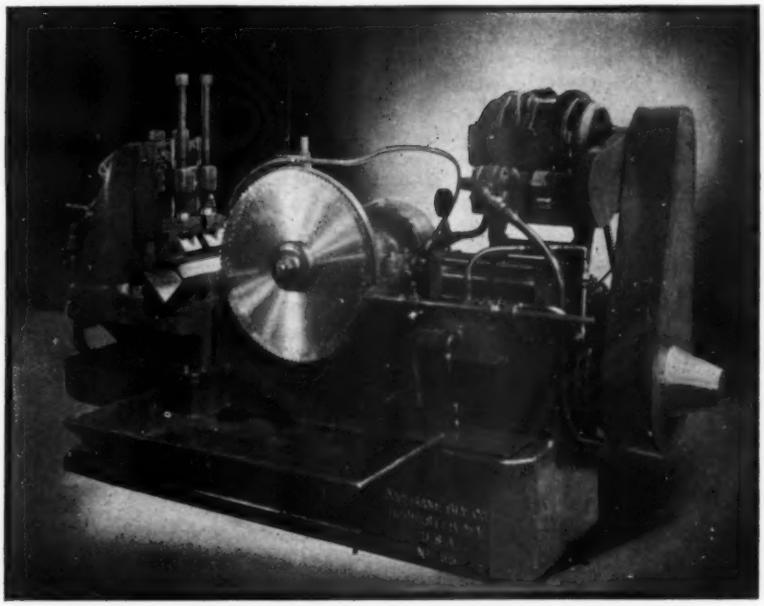


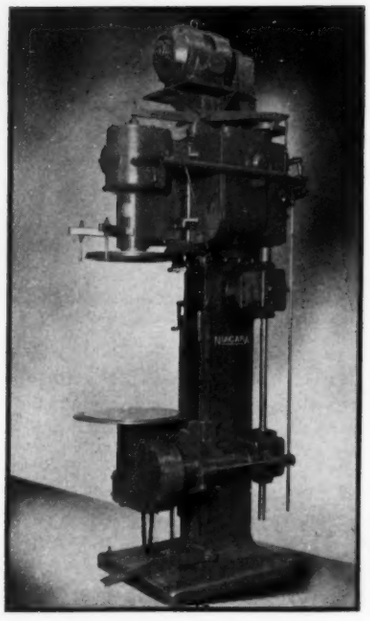
Cochrane-Bly High-Speed Hydraulic Cold Saw

Intended for use in cutting nonferrous tubing and bars, the high-speed hydraulic cold saw announced by Cochrane-Bly Co., Rochester, N. Y., has a four-speed sliding-gear transmission. Remote control is provided for changing the saw speeds from 235 to 600 ft. per min. cutting speed, and the hydraulic feed is adjustable from 0 to 60 in. per min. Machine has automatic trip and rapid return of carriage, and rapid forward traverse of carriage. Adjustable stops regulate carriage travel to the size of tube being cut.

Vise is hydraulically operated with a compound toggle-link and a vertical slide carrying adjustable clamp screws at each side of the saw blade. These screws are fitted with removable V or radius blocks to prevent distortion of thin-walled tubing under clamping pressure.

This saw has capacity for tubes up to 8 in. diameter and will cut tubes of this size in 8 sec. cutting time. An extended pan provides storage space for chips and permits easy access of a shovel for their removal. The tank for hydraulic oil is located under the base of the machine, and a sump is provided for drainage of cutting oil. Drive is through multiple V-belts, and a friction clutch is provided for instant stopping and starting. Weight is 5,000 lb.



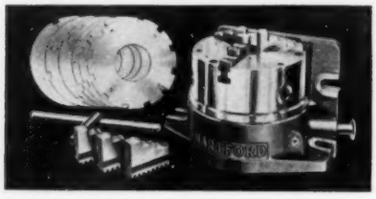


Niagara Double Seamers

Two vertical, single-end, double seamers, for semi-automatic double seaming of heads in metal containers, have been announced by Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Featured in the design of these machines are variable cams for changing the ratio of feed at which the rolls operate. Pick-off gears make it possible to vary the ratio between spindle and seaming rolls. Model No. 304 has a capacity for 24 gage material; No. 305, illustrated, handles 22 gage stock.

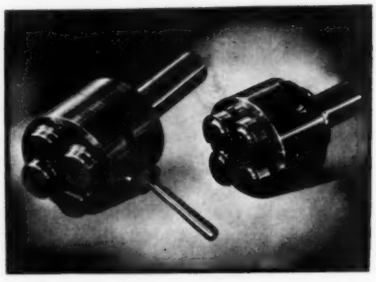
Hartford "Super-Spacer" Indexing Chuck

The Hartford Special Machinery Co., Hartford, Conn., is manufacturing the "Super-Spacer" indexing chuck which combines the features of quick set-up, rapid indexing, accuracy, prevention of errors, rigidity and adaptability. The unit consists of a base in which is mounted a flanged turret having a master index plate and provision for mounting mask plates. A standard steel-body chuck is mounted on the flanged turret, which is easily rotated when the clamp handle is released. The face of the chuck is ground flat and square to permit mounting fixtures for work-holding devices. Graduations are provided on the turret for setting the chucks for odd spacings. This tool may be used for milling, drilling, slotting or planing operations.



Specifications: over-all length, 12½ in.; over-all width, 9⅝ in.; over-all height, 7¾ in.; weight, 83 lb. The master index plate has 24 notches and is hardened and ground for accuracy. Mask plates with 2, 3, 4, 6, 8 and 12 spaces are furnished.

In operation the chuck holds the work in either a horizontal or vertical plane. The master index plate is readily changed from one set of divisions to another by using the proper mask plate. It is impossible to engage any index notch on the master plate except those left clear by the mask plate.



National Acme Hollow-End Milling Tool

The hollow-end milling tool, announced by National Acme Co., 170 East 131st St., Cleveland, Ohio, is designed to use circular cutters with the same micrometric adjustment and positive locking feature as is used in holding circular chasers. By using more than one step on the cutters, it is possible to turn several diameters with one pass. After the tool has completed the cut, the cutters are automatically released and backed off without marring the work.

Adjustment for diameter is provided in the tool. Cutters are sharpened much the same as ordinary cutters, but are set after sharpening by means of a micrometer gage to insure even distribution of the cut. The toolholder may be used as a standard self-opening automatic diehead by changing from hollow milling cutters to circular chasers. Cutters may also be used for facing or turning a radius on a shoulder, if desired. Standard cutters are available for end turning diameters from 0.056 to 13⅜ in.

Aladdin Welding Rod

"Aladdin Rod," manufactured by the Aladdin Rod & Flux Mfg. Co., Box 935 Madison Square Station, Grand Rapids, Mich., applied according to instructions, makes a weld that is said to have as great a strength as the base material when used for welding white-metal die castings. Reinforcing is not considered necessary, except where improper design requires an increased section at the broken point.

Production Type SMC-1 Mechanical Counter

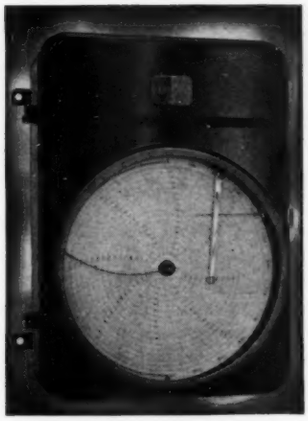
Production Instrument Co., 1325 S. Wabash Ave., Chicago, Ill., is manufacturing the Type SMC-1 mechanical stroke counter with capacity to 99,999. The over-all dimensions of this small counter are ⅞x1½x1¾ in. It is claimed that skips or overthrow of number wheels is effectively prevented.

This counter is of the non-reset type and can be furnished with the operating arm on either the right- or left-hand side of the case. Lever throw of ½ in. brings the next figure

into a legible position with positive action. This counter is suitable for use on office machines as well as on production machinery.

Bristol Round-Chart Potentiometer

The Pyromaster recording potentiometer of the round-chart type, announced by The Bristol Co., South Main St., Waterbury, Conn., is available as a pyrometer, tachometer, resistance thermometer, millivoltmeter and milliammeter. This instrument requires no lubrication; it is not affected by normal plant vibration; there is no mechanical motion of any kind except when a change in the measured quantity takes place; and it can be used under rough plant conditions where the air is laden with dust,



moisture, and corrosive fumes. The operating machanism is made up of five small, compact units which are replaceable. There are no mechanical connections of any kind between the galvanometer unit and the other units. The pen is actuated so as to follow changes in the measured quantities as they occur and at a rate dependent upon the rate of change.

U. S. Asbestos Cord No. P-6031 Steam Hose

U. S. Royal asbestos cord steam hose No. P-6031, announced by United States Rubber Products, Inc., 1790 Broadway, New York, N. Y., is constructed of steam and heat-resisting rubber tube with four-ply asbestos cord wound spirally in alternating direction. These cords are cushioned in a layer of rubber and are wrapped in a heat-resisting rubber cover.

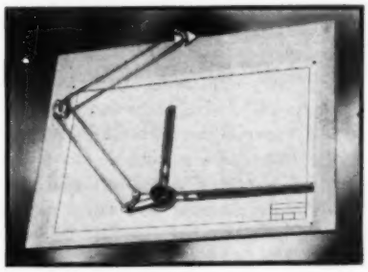
This hose is made four-ply in ½, ¾, 1, 1¼ and 1½ in. inside diameter sizes. Maximum lengths are 50 ft. and the hoses will accommodate pressures ranging from 175 to 200 lb.

Jeffrey Protected-Screw Takeup

A protected-screw takeup for conveyors and elevators has been announced by Jeffrey Manufacturing Co., Columbus, Ohio. The adjusting screw is protected from dust and dirt by an inverted U-shaped shield which extends from end to end of the take-up frame. The sliding base casting, which carries an adjustable nut of bronze, is cored out in such a way that it slides freely over the shield, thus relieving the shield of any function other than protection of the screw. As the adjusting screw does not travel, but remains inside the frame, it is protected from damage at all times.

Wrigraph Model R-300 Drafting Machine

Wrigraph Sales Division, 5205 Euclid Ave., Cleveland, Ohio, is marketing the Model R-300 Wrigraph drafting machine. A mounting clamp holds the machine on any drawing board and the unit is self leveling;



it will make drawings up to 28x38 in. The parallel mechanism is permanently calibrated and it is assembled with eight ball bearings, which are prelubricated. Aluminum alloy castings are used and all parts are given a dull, satin finish to prevent glare.

One degree angles can be obtained in one operation with the new indicating protractor, which can be clamped against rotation. An automatic stop makes it possible to accurately return the protractor to the zero position.

Clark Lift-Jack Wire Coil Truck

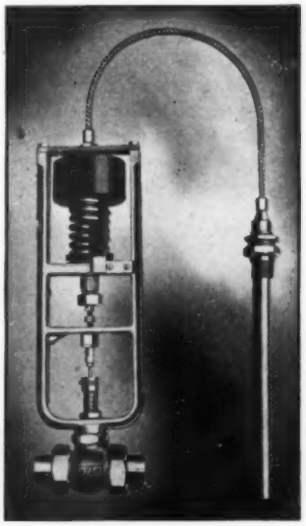
The Clark wire coil truck, manufactured by All Steel Welded Truck Corp., Rockford, Ill., is adapted for use wherever quantities of wire coils are to be transported, whether in the production line, warehouse or receiving room. The operator can roll coils on the platform from the rear or from either side. Corrugations on the deck hold the coils in position.

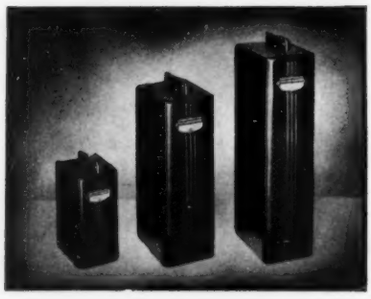
Standard specifications: Length over-all, 56 in.; height to top of platform, 3¼ in.; clearance, 1¾ in.; height of front bar, 41 in.; width at

wheels, 30 in.; width at loading platform, 15 in.; weight, 140 lb.; capacity, 2,500 lb. Trucks of other specifications can be furnished. This truck will operate with any Clark lift-jack and is easily handled in narrow shop aisles.

TAG Controllers

C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y., has announced improvements in the TAG line of self-operating temperature controllers. These improvements include a new design of flexible seamless metal bellows and several minor refinements of design, material and workmanship. The new model is suitable for industrial applications where the close control obtainable with auxiliary power is not necessary or where the steam pressure available is less than 10 lb. per sq.in. Temperature ranges are approximately 75 deg. between the limits of 30 and 450 F. The valves are semi-balanced and are available in sizes from ½ to 2 in. and they will close against 125 lb. pressure.





C-H Drum Controllers

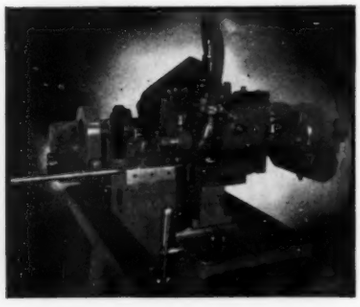
Cutler-Hammer, Inc., 205 N. 12th St., Milwaukee, Wis., is manufacturing a line of fractional-hp. drum controllers for use with reversible a.c. squirrel-cage motors and reversing or non-reversing multi-speed squirrel-cage motors driving machine tools and similar machines where speed regulation is desired. A removable case incloses the compact mechanism, which offers features such as an insulated cylinder to which the segments are secured, renewable contact fingers mounted in individual bakelite moldings, and a self-indexing, positive action drum.

"Producto-Matic" Milling Machine

The No. 2½ "Producto-Matic" milling machine, offered by the Producto Machine Co., Bridgeport, Conn., is cam operated, thus providing full automatic operation of the machine without the attention of the operator. Four cams are used: one for horizontal and one for vertical travel of cutters; the third cam opens and closes the work-holding jaw, and the fourth cam operates the feeding device.

Work-holding jaws can be constructed to accommodate various types of bar stock. Jaws are so constructed that pieces do not jam in the jaw or between cutters after being cut-off. Material of round, square, hex or any extruded or formed shape within 4 in. square can be handled.

The machine shown is tooled for performing a milling and cutting-off operation from bar stock. Material is fed into the work-holding jaws by means of an automatic feeding device. The work shown is cold-rolled steel bar stock, $\frac{13}{16}$ in diameter. Two pieces are finished at one cut and the production is 200 pieces an hour.



G. E. "Rotating-Cam" Control Switches

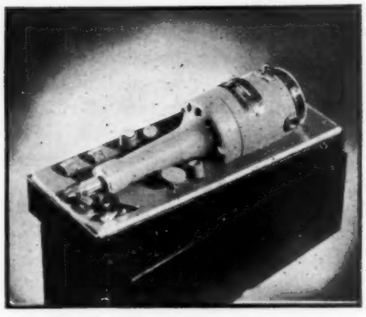
A line of rotating-cam switches, designed especially for built-in control applications and adaptable to a variety of electrical functions and machine requirements, has been placed on the market by General Electric Co., Schenectady, N. Y. For non-built-in applications, these switches are available as standard units without the flanges used for flush-mounting on machines. Designated as G-E CR3300 rotating-cam switches, the line is manufactured in a number of electrical and mechanical modifications making it universally adaptable to applications varying from machine-tool motor control to steel-mill master switching.

"Wet-X-Hale" Paint-Compound

Offered by the Wet-X-Hale Paint-Compound Co., 572 Greenwich St., New York, N. Y., "Wet-X-Hale" is a compound, which, when mixed with paints, lacquers and varnishes, can be safely applied directly on damp, moist and wet-from-rain surfaces. In spite of the moisture-deposit on surfaces and more moisture in the air, the reaction of this compound causes moisture-proofing and rust-proofing and deposits the paint film firmly on the moisture-proofed surfaces underneath. Only five parts of the compound are required for 95 parts of paint and the combination is applied with either a brush or a spraying apparatus. The compound reacts with the water, then separates from the paint and forces itself, with the absorbed water through the paint to the top of the film, where the entire water-laden compound decomposes and evaporates completely.

Dumore No. 10 Hand Grinder

The No. 10 hand grinder, recently announced by The Dumore Co., Racine, Wis., has a 1/18-hp. dynamically balanced motor, a ⅛-in. collet chuck, and a three-bearing construction using precision grease-scaled ball bearings. Equipment included with this grinder consists of mounted wheels, abrasive bands and arbor, wrenches and a toggle switch built into the case. Speed is 20,000 r.p.m. and the weight is 2 lb., 12 oz.



Westinghouse Midget Linestarters

A complete line of remote-controlled, reversing and non-reversing magnetic starters for small single-phase and polyphase, squirrel-cage induction motors has been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The non-reversing contactors are particularly adapted for use with motors driving air - conditioning equipment, small compressors, small pumps, fans and small machine tools. Contactors are available for ½ hp., 110 volts or 1 hp., 220 volts, single pole or two pole, single phase, for use either as a remote-controlled line switch or as a motor starter.

American Machinist — REFERENCE BOOK SHEET

Use and Care of Wire Rope

Wire rope is used for many industrial purposes such as hauling, hoisting and power transmission. Its strength depends primarily upon the material from which the wires are made. Iron and steel (cast, plow and improved plow) are generally used. Requirements of the Federal Specifications for wire rope (RR-R571) specify the minimum strength of the wire as 70,000 lb. per sq. in. for uncoated iron wire to 230,000 lb. per sq. in. for uncoated improved plow steel wire. Average strength of wire rope from destruction tests is 82½ per cent of the aggregate strength of all the wires.

Wire rope is made with different numbers of strands and numbers of wire to the strand according to the use. The greater the number of strands and number of wires per strand, the more flexible the rope. Standard hoisting rope is made of six strands with nineteen wires to a strand. This type is used for elevators of all kinds, in mines, and for conveyors, coal hoists, derricks and similar hoisting equipment. Special flexible hoisting rope is made of six strands with 37 wires each, and extra flexible of eight strands with nineteen wires each. These ropes are used for cranes, counterweights, hoists, dredges and kindred uses. Standard haulage or transmission wire rope is made from six strands with seven wires each, and is much stiffer than hoisting rope, and because the wires are larger does not wear through so quickly. Galvanized rope is not suitable for general hoisting and hauling. The core of a wire rope is fibre saturated with a lubricant as a rule. The core provides little additional strength but does act as a cushion to preserve the shape.

The proper factor of safety for a wire rope should be determined by consideration of all pertinent data. These include such factors as type of loads, acceleration, deceleration, rope speed, rope attachments, number, size and arrangement of all sheaves and drums, existing conditions causing corrosion and abrasion, length of time the rope is in service and economical rope life. The factor of safety should never be less than 5 and may vary up to 8 or more for safe and economical operation.

Good practice requires that the tread diameter of sheaves or drums (diameter at bottom of rope groove) be not less than those given in Table II. The groove diameter of a sheave or drum for wire ropes having a diameter of ¼ in. to 1¼ in. inclusive should be $\frac{1}{16}$ in. greater than the diameter of the rope. For a rope having a diameter of $1\frac{1}{16}$ in. to 2½ in. inclusive the groove diameter should be ⅛ in. greater than the diameter of the rope. Grooves should be spaced so that one part of the rope will not crowd or rub against another part. Multiple layer winding should be avoided because the rope will mash and its life will be shortened materially. Where two or more layers are wound on a drum the last groove in which the rope winds should rise gradually above the others so that it will raise the second layer of rope without strain or shock above the first layer.

Wire rope should be handled care-

Table I—Strength, Proper Working Load, Sheave and Drum Diameters for 6x19 Uncoated Wire Rope with Fiber Core

Nominal Diameter in Inches	Approx. Circumference in Inches	Minimum Breaking Strength (Pounds)				Proper Working Load (Pounds)				Recommended Diameter in Inches for Sheave or Drum
		Iron	Cast Steel	Plow Steel	Improved Plow Steel	Iron	Cast Steel	Plow Steel	Improved Plow Steel	
¼	¾	.....	4,100	4,880	5,600	.....	820	975	1,130	12
$\frac{5}{16}$	1	.....	6,240	7,600	8,780	.....	1,250	1,520	1,750	14
⅜	1⅛	4,000	8,780	10,700	12,300	800	1,750	2,140	2,460	17
$\frac{7}{16}$	1¼	5,380	11,700	14,200	16,400	1,075	2,340	2,840	3,275	20
½	1½	6,960	15,000	18,300	21,100	1,390	3,000	3,650	4,225	23
$\frac{9}{16}$	1¾	8,760	18,700	22,800	26,300	1,750	3,750	4,550	5,250	25
⅝	2	10,800	23,000	28,100	32,400	2,150	4,600	5,625	6,475	28
¾	2¼	15,300	32,800	40,200	46,200	3,050	6,550	8,050	9,250	34
⅞	2¾	20,700	44,500	54,600	62,800	4,150	8,900	10,925	12,550	39
1	3	26,700	57,500	71,200	81,900	5,350	11,500	14,250	16,375	45
1⅛	3½	.....	72,200	89,700	103,000	.....	14,450	17,950	20,600	51
1¼	4	.....	89,700	110,000	127,000	.....	17,950	22,000	25,400	56
1⅜	4¼	.....	107,000	133,000	153,000	.....	21,400	26,600	30,600	62
1½	4¾	.....	127,000	157,000	180,000	.....	25,400	31,400	36,000	68
1⅝	5	.....	148,000	183,000	211,000	.....	29,600	36,600	42,200	73
1¾	5½	.....	172,000	211,000	242,000	.....	34,400	42,200	48,400	79
1⅞	5¾	.....	195,000	240,000	277,000	.....	39,000	48,000	55,400	84
2	6¼	.....	222,000	273,000	314,000	.....	44,400	54,600	62,800	90
2¼	7⅛	.....	281,000	343,000	394,000	.....	56,200	68,600	78,800	101
2½	7⅞	.....	343,000	417,000	480,000	.....	68,600	83,400	96,000	112
2¾	8⅝	.....	413,000	499,000	573,000	.....	82,600	99,800	114,600	124

Note: The above breaking strengths have been taken from Federal Specifications for Wire Rope RR-R571 and the drum and sheave diameters have been computed as recommended in those specifications. In computing the working loads the factor of safety of five usually used for general hoist loads has been employed. If drums or sheaves of smaller diameter than those recommended are used, the working loads should be decreased, using a factor of safety of not less than six to eight. For freight and passenger elevators the factor of safety should be as specified in National Safety Code for Elevators, Dumbwaiters and Escalators.

Use and Care of Wire Rope

Table II—Recommended Tread Diameters of Wire Rope Sheaves and Drums

Rope Construction		Minimum Tread — Diameter of Sheave or Drum
Number of Strands	Number of Wires in Strands	
6	7	72 Times the nominal diameter of the wire rope.
6	19	45
6	37	27
8	19	31

Table III—Intervals for Refastening Rope

Expected Life of Rope — Months	Maximum Time Between Refastening — Months	Expected Life of Rope — Months	Maximum Time Between Refastening — Months
6	1	21	3½
8	1½	24	4
10	2	27	4
12	2	30	4
15	2	36	4
18	3		

Table IV—Seizing Wire Sizes

Wire Rope Diam. (Inches)	Seizing Wire Diam. (Inches)
¼ to ⅝	0.054
¾ to 1½	0.105
1¾ to 3¼	0.135

fully so that it neither is twisted or untwisted. Care should be taken to avoid kinks as the wires at a kink are permanently bent and damaged and the rope itself is usually damaged beyond repair. If the kink has not been "pulled through", that is, pulled into a loop of only a few inches, the wire rope can be straightened by using a kink iron. This tool is a 3-ft. bar with two short pieces welded near one end so that their axes are at right angles to the bar. The first piece may be 1 in. from the end of the bar and the second piece 2 in. from the first piece.

If wire rope is to be unwound from a reel there are three correct methods:

1. The reel may be mounted on a shaft supported by two jacks and the rope pulled from the reel by holding one end and walking away from the reel which rotates as the rope unwinds.

2. The reel may be mounted with its center hole vertical and on a turntable and the rope unwound in the same manner as in method (1). Slack must be prevented or a kink will be formed that may ruin the rope.

3. The end of the rope may be held and the reel unrolled along the ground.

If a wire rope is coiled the outer end of the rope should be released and the coil rolled along the ground like a hoop. Under no circumstances should the coil be laid flat and the loops thrown off and pulled out as this will certainly result in a kink.

The end of a wire rope should be seized to prevent unlaying. Annealed iron wire of the diameters given in Table IV should be wound tightly in a close helix around the rope. Before cutting steel wire rope, it is essential to place at least three sets of seizings on each side of the intended cut.

All wire ropes, whether for inside or outside work, should be treated at regular intervals with a lubricant to keep them pliable and prevent rust. Compounds of cylinder oil which will penetrate and lubricate the inner wires are best.

Service Life

Sometimes wire ropes are discarded because the "stretch" is apparently gone. The "stretch" is nothing more than the settling into place of the strands of the rope, and after this has taken place the rope is still good provided the wires are not broken. In fact, some wires break when a new rope is put into service because they are adjusting themselves to an equalization of stresses. However, after the rope has had considerable service, the breaking of wires becomes important because useful life of the rope is ended. The rope should be renewed if it shows 10 per cent of broken wires per lay or when adjacent broken wires in one of the strands exceed 20 to 25 per cent of the wires in that strand, even if the rope does not show appreciable wear. This recommendation applies to wires which are not used on equipment for hoisting people. In this case the rope should be renewed in any event when the outside wires are worn to a thickness of one-half their original diameter even if there are no broken wires.

Abstracted from Safe Practices Pamphlet No. 26 entitled "Wire Rope" and published through the courtesy of the National Safety Council, Chicago.

Round Table

How Interchangeable?

"Williams took me to a meeting the other night, Al, where we heard a swell talk on interchangeability."

"That's good, Ed. You don't get out to enough meetings of that kind. How was it?"

"Fine, Al. He told us how easy it was to work to close tolerances and showed us a lot of auto parts that are held to half thousandths or less. Williams was a bit skeptical, but it sounded good to me."

"It may not sound so good after you've tried it awhile, Ed."

"But think of the saving in assembly, Al. Think of all parts going together with no trouble at all."

"It's good so far as it goes. But you've got to use horse sense in interchangeability as in anything else."

"But if it doesn't cost any more to work to close tolerences, as he says, why not do it? Don't you make our pumps interchangeable, Al?"

"Yes and no, Ed. Like most things, it needs explaining."

"I don't see it, Al. Work is either interchangeable or it isn't."

"That again needs explanation, Ed. If you can have an appreciable allowance between the fitted parts, such as anywhere between one to ten thousandths, it's a cinch. But if you can't have more than a thousandth, you've got a real job on your hands. And most of the time it isn't necessary to work that close."

"Are you trying to tell me our pump parts are not interchangeable?"

"Not all of them, Ed. It isn't necessary."

"But how about supplying spare parts to fit? Can't you do as well as the auto builders with the thousands they build?"

"Not by a long ways, Ed. They have very fine, special machines that we can't afford. But don't get the idea all auto parts are interchangeable, because they're not."

"They must be, Al. I never bought a spare part that didn't fit."

"Probably not. But the parts you bought were not the ones that have to be selected. You can't buy a piston or piston pin or a connecting rod without having it selected for your motor."

"Cylinder bores must be all alike, Al."

"But they measure each one and select the piston to suit, Ed, and the same with piston pins. They are held to half thousandths, but they

select to get best results. We make all our sub-assemblies so they will interchange on the pump itself. But there may be slight variations in some of the parts. They give just as good service and save a lot in making and in scrap."

"I'll bet we can make all our stuff interchangeable, Al. Williams may be skeptical, but he'll do it if the boss says so."

"And the boss will kick at the increased cost."

"But we'll have a better product, Al. That's something."

"The customer will never know the difference. I'm for interchangeability only as long as it pays."

Is Al correct in maintaining that interchangeability is a matter of judgment? Or is it better to go "whole hog" as Ed suggests?

Discussion

Open House

An "Open House" has its good points but I am inclined to oppose it. It is true that much is to be gained in the way of advertising in permitting visitors to view the interior of the plant. I would limit, however, the area of sight seeing so that there would be no interference with production. To permit visitors to wander about unaccompanied by a proper guide is disorganizing and dangerous.

The chief danger lies in the disclosure of trade secrets. I hope that I am not misunderstood in this respect; I am not of the old school wherein there is great opposition to legitimate exchange of ideas. This is conducive to progress. There is no use in a manufacturer, who has spent thousands of dollars in developing an idea or process, suddenly becoming eleemosynary and divulging to his competitor what is rightfully his alone for a reasonable length of time. A manufacturer is entitled to industrial security.

I recall an incident that occurred

many years ago. We were having a hard time competing with another manufacturer because he had the edge on us in methods of production. We could not meet his price and so it was decided to resort to the methods of Troy and gain access to his establishment. An intrepid volunteer took a night train out of town in the guise of a salesman and bright and early the next morning he arrived at the competitor's plant. He immediately met the superintendent and soon gained the good graces of the unsuspecting one by evincing a great interest in shop atmosphere. The super prided himself in a well-run shop and invited the "salesman" to "Come on through". With outward delight and a burning conscience he followed and in a short time had accomplished his purpose. He took home the industrial bacon to his employer. He had secured the information on the production of a certain part which placed his employer on a more equal footing and obviously placed the originator of the idea at a great disadvantage.—J. HOMEWOOD.

Large auto and tire plants do escort visitors through their plants, but only on prearranged schedules. They show the public what they want them to see, and no more. Only certain favored visitors get into the development departments, for instance. The success of many concerns depends on their patents and they cannot afford to let the world have free access to ideas that have cost them thousands of dollars to develop.

In Al's particular case, I think the Family Day idea would prove workable. Set aside one afternoon a week for visitors. New developments in process can be hidden away for that time and visitors can be shown the shop under the best conditions. No woman will be shocked then at the language she might hear if one of Al's boys breaks off a tap flush with a pump housing, nor will the secret of that new kink for dynamic balancing leak out to a competitor. Accidents, too, will be fewer if visiting is controlled. —J. K. MATTER.

It is not practical for a small machine shop to keep "Open House" all the time. This is especially true where the product is not sold to the general public.

Generally a small shop is crowded for room. Too many visitors will be in the way and interfere with production. Visitors frequently ask silly questions and someone must stop their work and answer these questions. New faces always attract attention whereas the mechanic should keep his mind on his work and his machine if he is to produce accurate work in an efficient manner. Should the firm stand the expense incurred by these visitors? I think not.

While it may be interesting to children to see their father at work I do not believe a machine shop is any place for children. They are too inquisitive. They are apt to put their fingers in places where they shouldn't and accidents result. They also have a faculty of getting in the way.

"Open House" once a year is an excellent idea. A designated day set aside for "Open House" will give everyone an opportunity to see the product and how it is made. The rest of the time should be devoted to making the best product procurable at a reasonable price.

While this is particularly true of small plants, it is also true of large plants. The good will thereby secured is offset by the time consumed in explaining to visitors the various operations. It takes three hours to go through the plant of a large manufacturing concern making typewriters. A guide must be furnished and this guide must have a comprehensive knowledge of the product and the different processes of fabrication. This guide could devote his time and energies to other matters of more importance to the concern. The firm recognizes this fact yet they are in a difficult position where they cannot refuse admission to their plant.

—ROGER C. DICKEY,
The International Paper Box Machine Company.

Tool Tickets

The disadvantage of most tool ticket systems is the opportunity offered workmen to secure an unlimited number of tools from the tool crib, and for their own convenience store them in drawers and lockers.

With the brass check system such procedure is impossible as a man is limited by the number of checks issued to him. In consequence better control over tools is obtained, and a minimum tool inventory is made possible.

Evidence of abuse or tool failure should be readily apparent to a seasoned tool crib attendant, and replacements should not be made without a written order from the shop foreman.

Most small tools are of sound design and uniform quality, and failures are in most cases due to improper grinding. All tools should be ground in the tool room by competent tool grinders and with equipment well suited for that particular task.

—IRA S. WILLIAMS.

Although the small tool item runs into money over a period of time, I doubt if the system Al advocates is justifiable in a small shop, especially in the toolroom. The variations in types of jobs that come through the toolroom necessitate various types of tools for short periods of time, thus creating a condition that would keep workmen busy in the details associated with the paper slip system.

Since foremen and officials of a small plant are in close contact with operations and men, the chronic tool-breakers and unsatisfactory performance of specific makes of tools can be singled out readily. I may add that setting up of standards for small tools is neglected in the small plant, and they should be kept up to date.

—PETER L. BUDWITZ.

Good as New

Some men seem to be slightly mixed up in the use of the terms "repair," "recondition" and "rebuild." Other men, and sometimes the same men, get mixed up when referring to rebuilding and replacing.

Repairs may be a broken bolt or a tooth out of a gear, even though the entire machine might be completely torn down to get at the one part, large or small.

Reconditioning might be the replacing of bearings in an old turret lathe with roller bearings or heat-treated gears in place of some of the old cast gears.

Rebuilt would mean the complete dis-assembly of the machine, planing of worn surfaces, replacing worn or cast gears and all bearings. Upon a decision to do such work as against replacing must rest the features of successful management.

Too often new "developments" have too great a bearing on a decision to purchase equipment that, when installed, does not by its production rate justify the expenditure.

Sometimes management lets itself be influenced by subordinates who see only new developments and not the utility of present machines. I have many times suggested the installation of modern roller bearings in old machines to make them even superior to "new developments" for the use at hand. —C. G. WILLIAMS.

Leipzig Sets a Record

JOHN HAYDOCK
Managing Editor

LEIPZIG, GERMANY—Leipzig in fair time is an old city full of new things. With the normal population of 750,000 swelled by an influx of 270,000 visitors from 74 nations, the city hums with activity for nine days and then settles back to a more leisurely life in a setting rich with tradition.

Toys, textiles, glassware, pottery and a thousand and one other products from the factories of nearly 9,000 exhibitors are displayed to catch the eyes of the visitors, but chief interest to those in the metal-working industry lies in the Technical Fair housed in 21 buildings especially constructed for it about five miles from the heart of Leipzig.

Hall 9, which contains the machine tool show, is ideally suited for the purpose. Railroad sidings, running into the building, and traveling electric cranes simplify the problem of setting up new machines each year. Only about half of the 188,000 sq. ft. of available floor area is taken by the booths, leaving wide aisles for the visitors to move about without too much crowding.

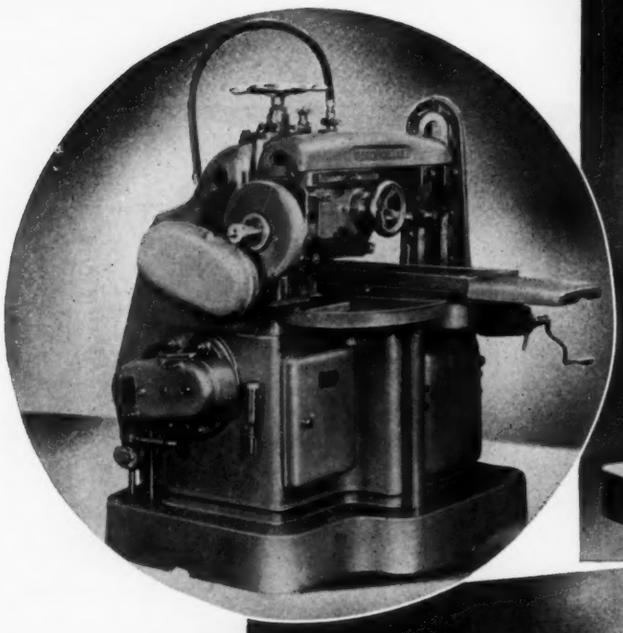
On the ground floor of Hall 9 alone 3,300 tons of machine tools were exhibited at the 1937 Technical Fair. In addition a balcony running entirely around the building held displays of light metal-working machines, accessories, abrasive wheels and anti-friction bearings. This year manufacturers of wood-working machinery had to be moved to Hall 11 because of the space needed by 161 machine tool builders. All available space had been reserved since March 1936, and 70 manufacturers had to be refused.

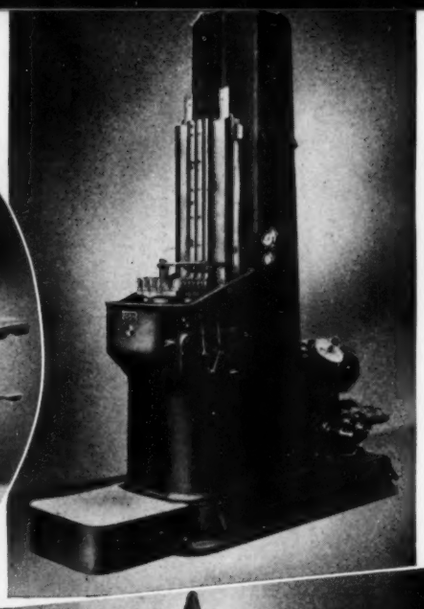
270,000 visitors jammed the Leipzig Spring Fair (Feb. 28—Mar. 8) beating last year's attendance by 50,000. Exhibition space was sold out and 70 German machine tool builders had to be left out

Displays merely for advertising purposes have been deliberately suppressed. Electric signs, loud speakers and potted palms are noticeable by their absence, leaving the visitor's attention free to concentrate on the machine tools themselves and their operation. For the first time a standard machine tool gray finish had been adopted for the displays in Hall 9 and, of course, added to the general appearance.

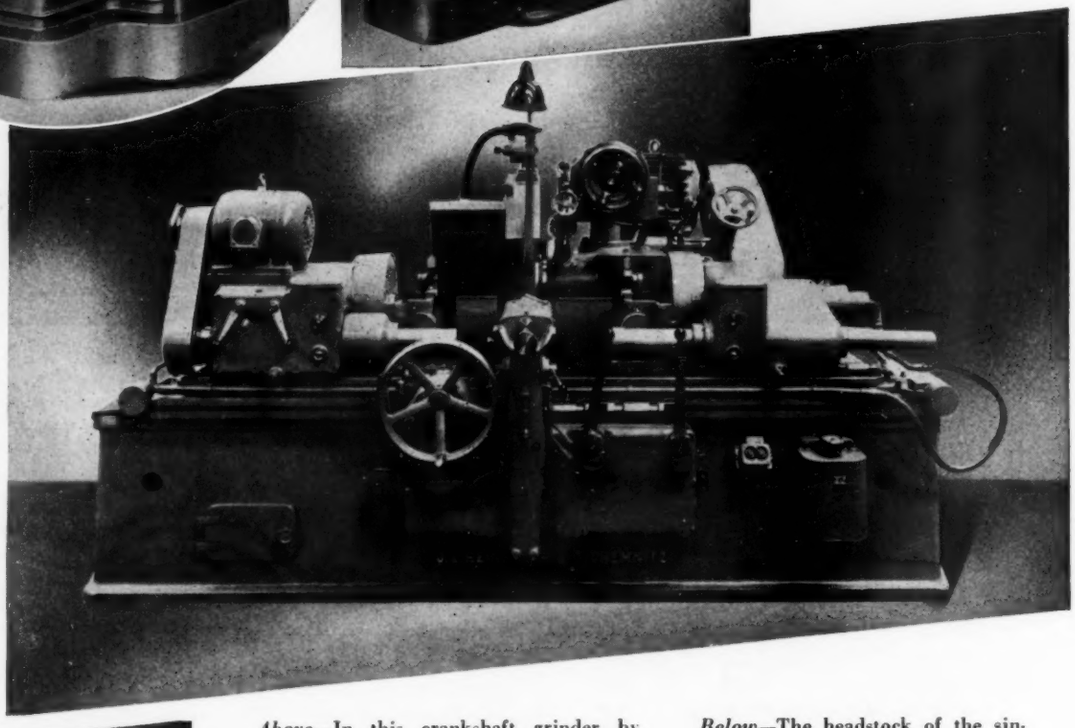
A number of trends in machine tools were apparent at the Fair. First, Germany's specialization on general-purpose machines as distinguished from high-production machines is fast disappearing. The increased output of German factories has made higher production essential and has resulted in more machine tools for repetitive manufacture. As in the United States, these units are designed to accommodate a wide variety of parts rather than for "single-purpose" application. However, the German manufacturers' chief point of excellence is still in the precision and fine finishing machines.

While the trend toward higher cutting speeds is still apparent, espe-

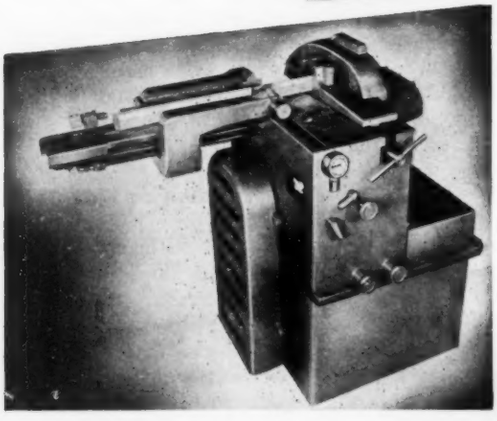




Left—A Forst hydraulic-drive vertical external broaching machine, shown by Alfred H. Schutte, Koln-Deutz, has a 45-in. stroke and 20,000-lb. ram pressure. The broaching tool ram is fastened inside the column guides. An "Enor" pump supplies oil to the cylinder which slides over a stationary piston. If the machine becomes overloaded because of dull tools or hard spots in the material cut, the machine will stop to prevent damage

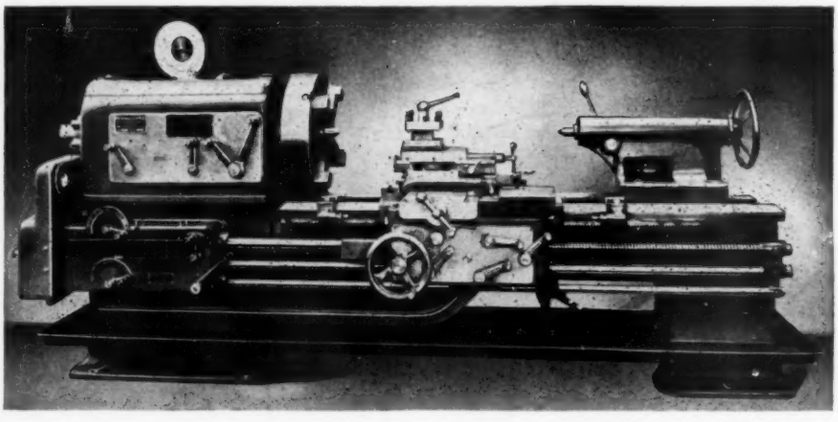


Above—In the milling machine by Werner, Berlin, the cutter spindle is mounted in a rigid quill having longitudinal adjustment by handwheel. A single lever starts the cutter spindle and initiates the automatic cycle as follows: quick approach of cutter to work, change to working feed, quick traverse over idle space, change to working feed, stop and brake of spindle at end of cut, and accelerated reverse of table



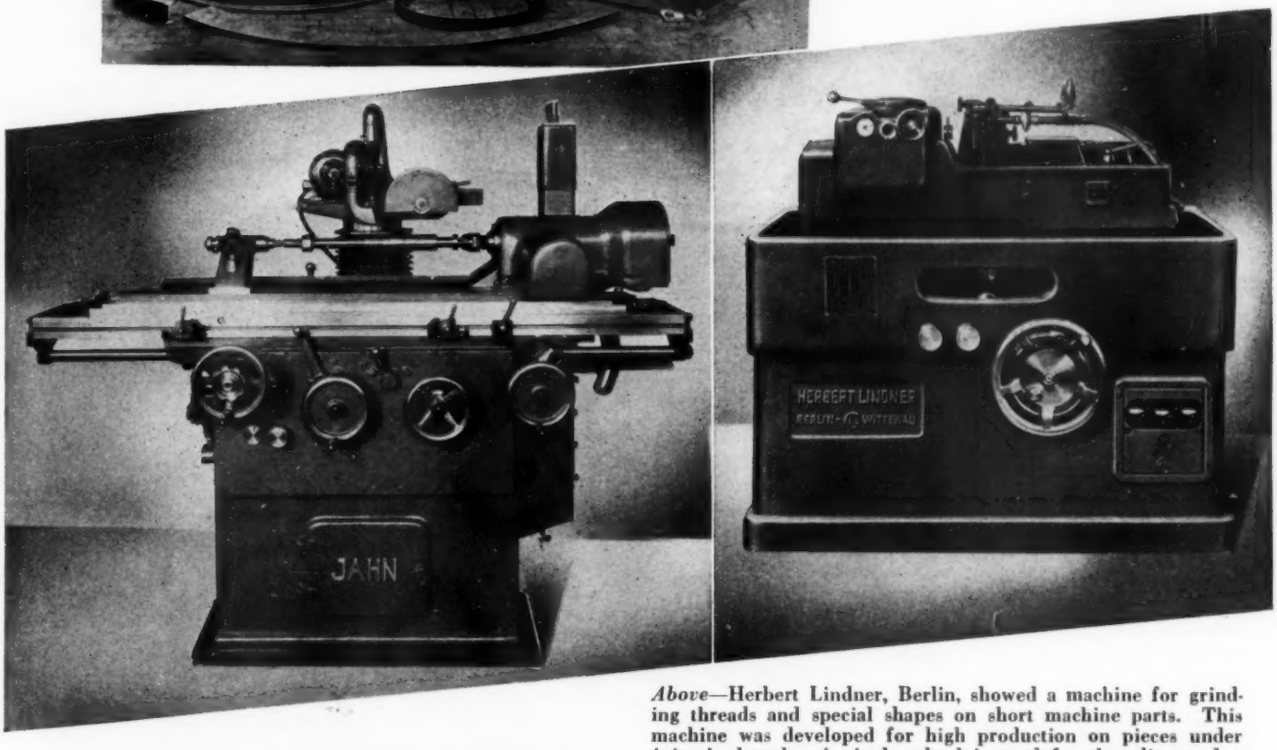
Above—In this crankshaft grinder by J. E. Reinecker, Chemnitz, hydraulic power takes care of the table adjustment, rapid traverse, plunge cut, motion of the grinding wheel, motion of the steady rest and clamping of the work-piece. The hardened and lapped grinding spindle runs in white metal bearings. Both heads drive the work-piece, have a capacity of 1,000 mm. between centers

Below—The headstock of the single-pulley lathe shown by Heymer & Pilz, Meuselwitz, includes a PIV gear in addition to three speed ranges obtained by sliding gears. The speed can be regulated under cutting pressure, and the speed range is sufficient to use carbide cutting tools to full advantage. A white-enameled indicator mounted on top of the headstock indicates the cutting speed in use, according to the diameter to be turned. Only one gear is mounted on the spindle which is supported by three bearings

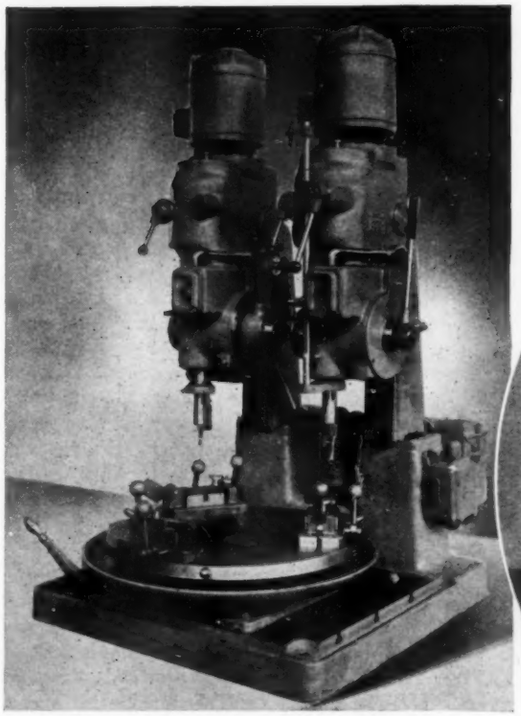


Above—The efficiency of an automatic metal saw by Franz Irmischer, Saalfeld, has been increased by reducing the time needed for clamping, bar feed and reverse movement of the saw without putting an additional burden on the cutting points. The special holding device is designed to give a clean-cut edge with minimum burr. The feed is hydraulic

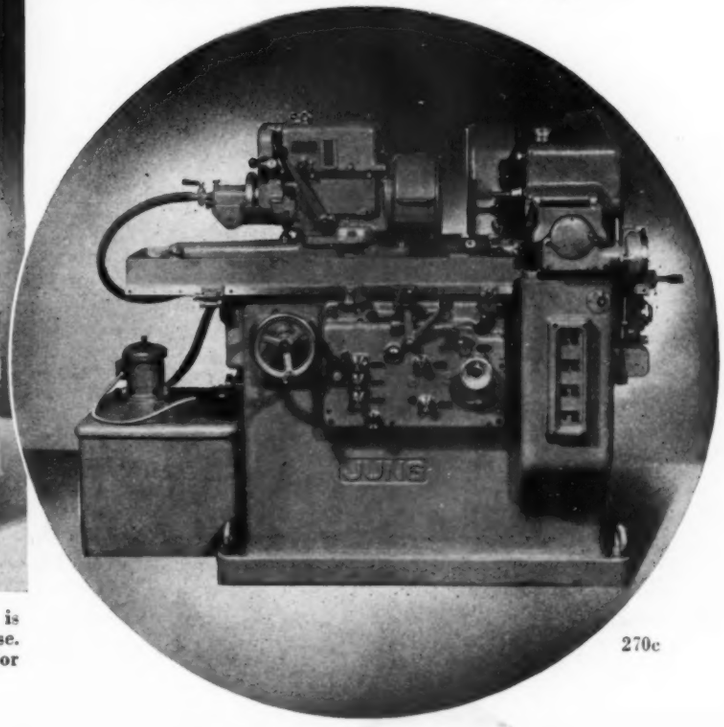
Left, at top—Rings of smaller diameter than were formerly possible can be made on these Pels angle bending rolls, in which the shafts carrying the rolls are in a slanting position. *Left, center*—Either hand or automatic control may be applied to the universal tool grinder shown by Fr. Aug. Jahn, Gera. A hydraulic gear gives the table a stepless feed control. The automatic dividing head may be used for plain indexing or spherical work. The headstock is adjustable for height



Above—Herbert Lindner, Berlin, showed a machine for grinding threads and special shapes on short machine parts. This machine was developed for high production on pieces under 4 in. in length. A single wheel is used for threading and a form wheel for irregular contours. *Below*—Pressing a push-button starts a complete cycle on the automatic internal grinder displayed by K. Jung, Berlin. The Jung method includes a roughing cut, automatic wheel dressing, and a finishing cut. Gaging is automatic, and when the required inside diameter is reached, the machine stops



A twin vertical drill by Gebr. Reinhold, Gera, is suitable for tapping with automatic spindle reverse. The hand-operated revolving table is provided for multiple set-ups



cially in lathes and shapers, it is not nearly so marked as in previous years. In general it may be said that German machine tools have caught up to the capacities of the new cutting materials. Emphasis now is placed more strongly on surface quality.

More than ever before, machine controls are being concentrated at one operating position. Push buttons are used frequently but usually only in groups of two or three rather than in the large banks seen on some American machines. The German designer has leaned more toward single-lever control in order that the operator may retain the "feel" of the machine without taking his eyes away from the cut.

Further progress has been made in the use of hydraulic control in order to obtain stepless feed for work tables or tool slides. A few manufacturers have used mechanical stepless drives, but these applications are not nearly so common as the hydraulic drives. There is also a trend toward welded construction by the use of arc-welded steel plate in place of castings. German designers, however, have not gone so far in this direction as those in America. Many of the leading German machine tool manufacturers recently adopted the practice of grinding the ways of the beds and tables in order to eliminate scraping. One reason for the wider use of this method is the increased hardness of the metal used in the castings caused by the introduction of nickel and other alloying elements. Such firms as Wanderer, Pittler, and Magdeburger Maschinenfabrik are using ground ways with good results. On the other hand, hardened steel ways are practically unknown in Germany.

For some years, the use of instruments to indicate cutting speeds, rate of feed, tool pressures, and other operating information has been more pronounced in German machines than in those built in the United States. There seems to be no increase in such usage and the high-production machines are usually found without such indicating gages. While the use of anti-friction bearings is very general, some manufacturers prefer plain bearings on the main spindles. As in the case of indicating instruments, this trend seems to have run its course. Emphasis has been placed on increased use of German materials in accordance with the Four-Year Plan of economic development. Every effort is being made to make such materials equal in quality to those obtained from abroad so that they will not be regarded as substitutes.

Fritz Werner, Berlin, showed a small vertical milling machine having nine speeds ranging up to 3,000 r.p.m. A plain spindle bearing is used with a ball thrust. A single lever may be moved in either direction to start the spindle, and further movement engages the feed in the corresponding direction. The center position stops both the feed and the spindle, and by pressing downward, a brake is applied. A multi-purpose horizontal milling machine may be operated automatically or semi-automatically. Rapid traverse brings the work up to the spindle, when the slow feed is engaged until the cut is completed. The table then returns automatically and will repeat the cycle or stop as desired. The spindle may be stopped during the return stroke.

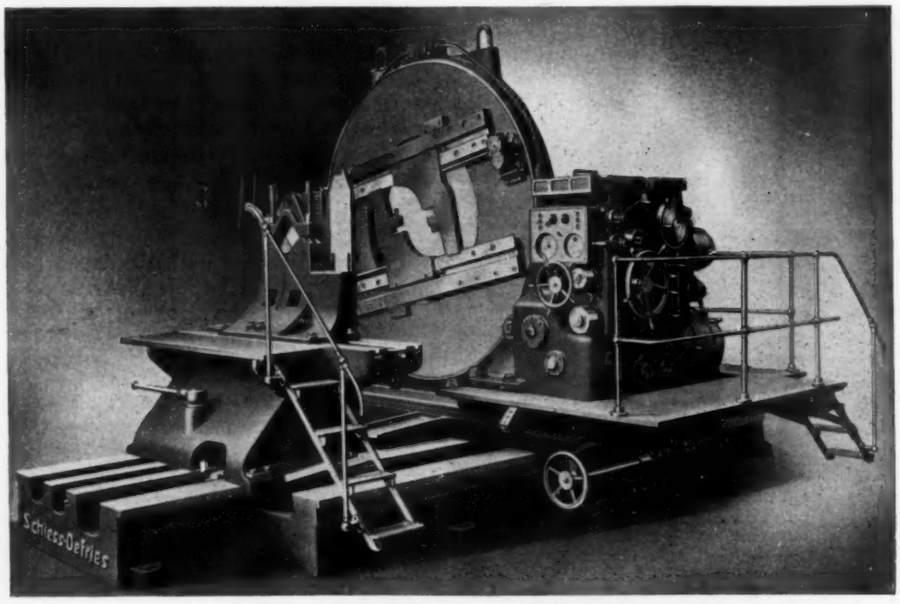
On the straight spline grinder shown by the same manufacturer, a hydraulic pump is driven through V-belts and is mounted on felt in order to eliminate vibration in the frame of the machine. The truing device is mounted on top of the wheel. The feed is arranged to be set in any number of thousandths desired and decreases automatically as the finished size is approached.

The line of turret lathes shown by Pittler, Leipzig, has a new high-speed electric driving mechanism. As in the past, these machines are provided with vertical tool turrets having sixteen positions. By the use of this number of tools, it is sometimes possible to turn out two pieces at each operating cycle.

A master cam is mounted in front of the work on the new camshaft grinder shown by Naxos-Union. The work carriage is pivoted so as to move in relation to the grinding wheel as guided by the cam. Rotating movements are electrically controlled but the longitudinal travel is hydraulic. Ground ways are used. The wheel is trued by hand.

In the roll grinder shown by the same concern, the crowning is obtained by eccentric bushings in the grinding wheel bearings keeping the wheel carriage solid. An ammeter connected with the driving motor shows the current consumed and makes it possible to see when the wheel touches the work. The ways are covered to protect them from abrasives.

Herbert Lindner has made further improvements in his line of thread grinders. A new small model grinds short threads at the rate of 30 an hour using the plunge cut method. The wheel is trued after every 50 pieces. This machine is also suitable



Large gas- and diesel-engine crankshafts are turned on the crankpins while stationary, the circular cutter head of this Schiess-Defries machine revolving

for grinding irregular contours by the use of formed wheels. Pushbutton control is provided. The ways can be inclined at any angle to suit the pitch being cut.

An internal thread grinding machine, also made by Lindner, has found wide use in making aircraft parts. Another machine, designed for jig boring, is arranged for optical setting of the work table to insure accuracy within 0.00005 in.

On a horizontal milling machine displayed by Biernatzky, single-lever control is used for the spindle feed and speed. Twelve feeds are provided, which may be increased to 36 by the use of change gears. A lever on the right-hand side of the machine selects the direction of the feed, while one on the left-hand side determines the rate of feed. Large direct-reading indicating wheels show the operator the feed and speed settings. A novel feature is the cutting oil tank, which is divided into two parts so that the pump may be changed over from a heavy cutting oil to a water solution.

Improved Screw Machines

Alfred Schütte displayed a line of Forst external and internal broaching machines. These are made in three sizes, 8, 16, and 30 tons. The six-spindle automatic screw machines made by Schütte have a new charging device which reduces the time of supplying new bars from 10 to 2 min. A green light shows automatically when the bars are reduced to a certain length, and a red light shows when the last piece has been cut. This allows a time interval to get the new bars in place. On the smallest size machine, which has a $\frac{5}{8}$-in. capacity, speeds are available up to 3,400 r.p.m. A special rear facing attachment is provided for finishing the piece after it has been cut off, thus avoiding a second operation.

Waldrich showed a new planer with a 10 to 1 reversing-motor drive using two 125-hp. motors driving a common gear. Reversing time has been reduced to 0.6 sec. on this machine.

A hydraulic shaper shown by Lange & Geilen has a head which travels laterally along the bed. The work tables may be adjusted to any convenient position. The cutting stroke is infinitely variable, but the return stroke is constant.

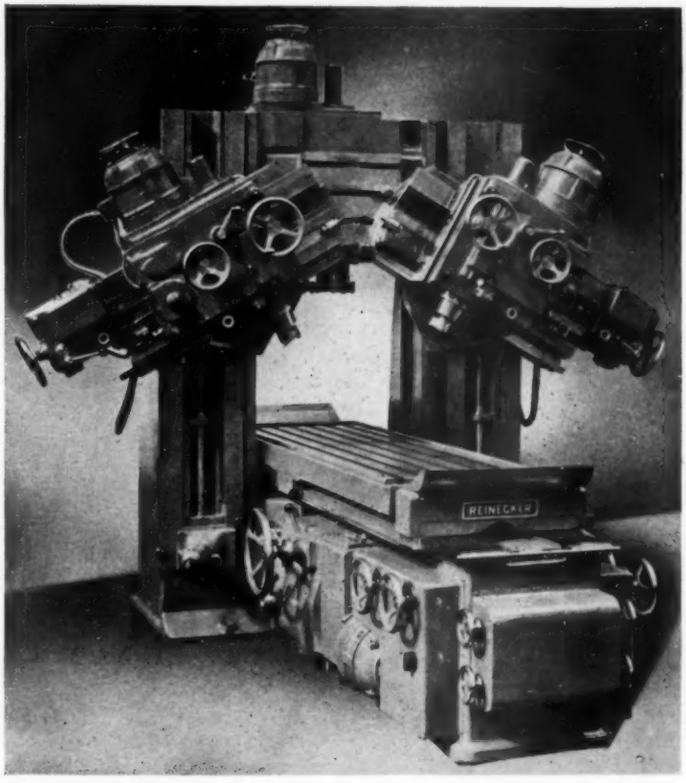
Carl Unger, Stuttgart, offered an automatic cylindrical grinder with hydraulic operation. After the machine is once set, the control is centered in one lever. Gaging is automatic with the machine stopping when the desired size is reached. This size is also shown on a dial gage and the feed is stopped for sparking out before the wheel is withdrawn. The truing diamond is placed at the center line of the work. Chucking is operated by a treadle which leaves both of the operator's hands free for loading or removing the work.

The line of surface grinders displayed by the Diskuswerke shows further development of their light welded-steel construction. These machines are made of sheet metal slightly under $\frac{1}{8}$ in. in thickness but so braced that it is claimed they have the strength of heavier cast parts. On one vertical surface grinder, the wheel is mounted on an arm which may be swung clear of the chucking surface to allow freedom in loading and unloading the work. These machines use a mechanically infinitely variable speed change manufactured by Hans Heynau.

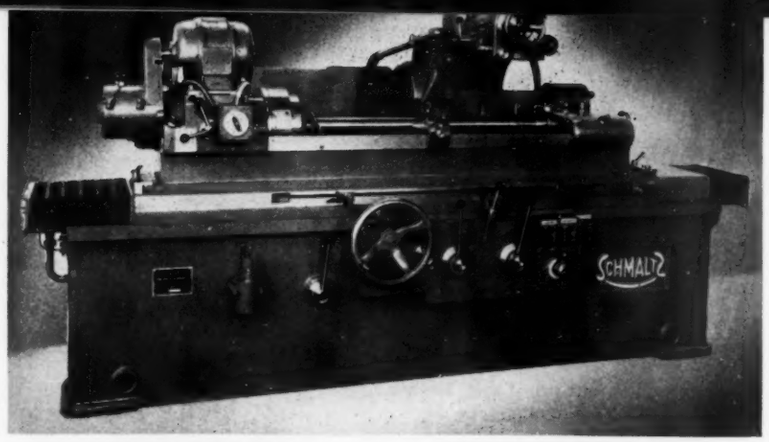
Among the precision measuring instruments by Carl Zeiss, Jena, was an optical alignment tester particularly designed for setting up large machines. This consists of a telescope, a target, and a lamp and may be applied to lengths from $3\frac{1}{2}$ ft. to 120 ft. Accuracy is obtainable to 0.0005 in. This manufacturer also showed a circular table for use on jig boring machines. A microscope is supplied to center the table with the boring spindle. The angular movement of the table is read optically and may be read to 10 seconds of arc. A new Zeiss vertical contour projector may be used on work held between centers or placed flat on a table. The work on the table may be illuminated from above or below as desired. The contour of the piece is projected on to the horizontal surface conveniently near the controls of the machine. The new large toolmakers' microscope has a capacity of 6x2 in. in stage travel. It also has angular adjustment and will read directly to 0.0001 in. The part is projected on a ground glass surface which may contain thread outlines or other contours as desired.

The line of milling machines shown by Loewe-Gesfuerel has an entirely electrical control. Separate motors are used for the drive and the feed. Central control with single-lever feed is used on a vertical millinm machine. When the machine has stopped, the spindle continues a few seconds after the table stops in order to clear the chips. One lever

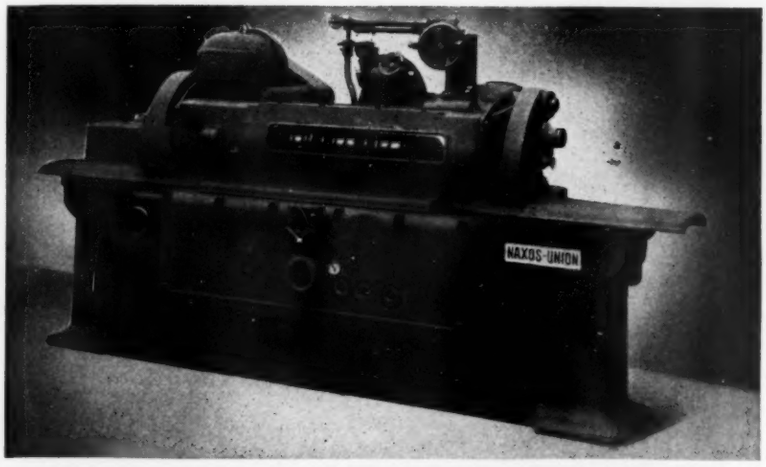
Three heads, each independently driven, are mounted on this Reinecker planer-type "frame" miller for engine blocks. It may be equipped with five spindles



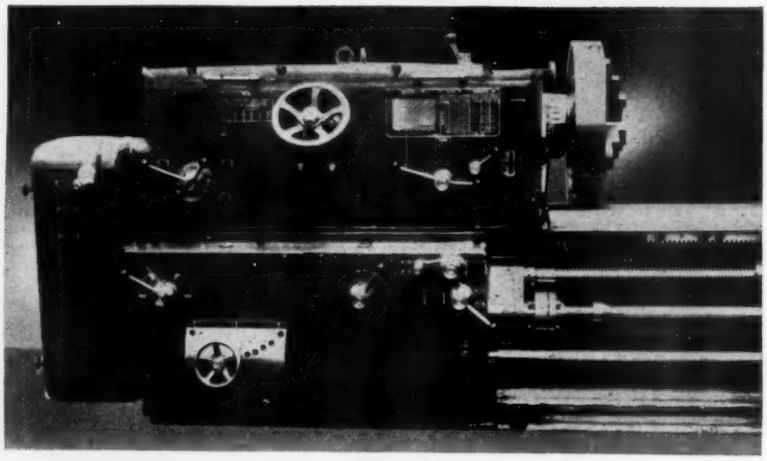
Right, top figure—Throwing a lever changes this grinder, by Friederich Schmaltz, Offenbach am Main, from plain cylindrical to plunge cut operation. The wheel is moved either by fine feed or rapid traverse. Bellows protect the carriage ways and drive is hydraulic



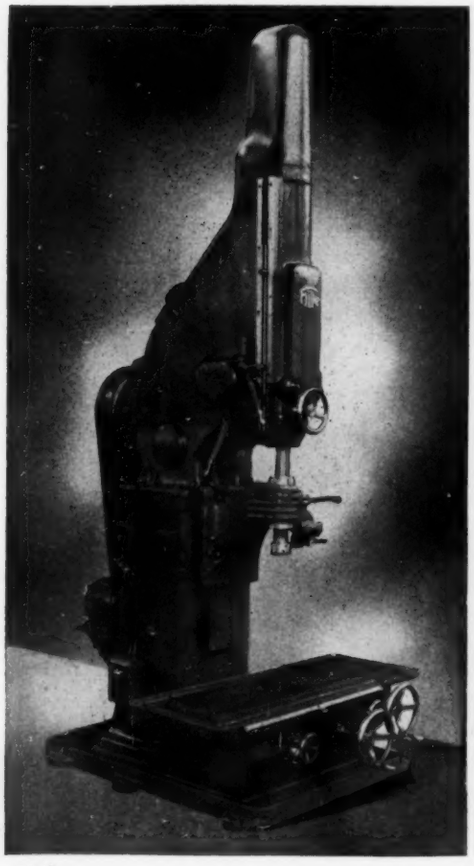
Right, second figure—The master cam is located in front of the work-piece in this Naxos-Union automatic camshaft grinder. The work carriage is pivoted to allow it to swing away from the wheel with the rise in the cams

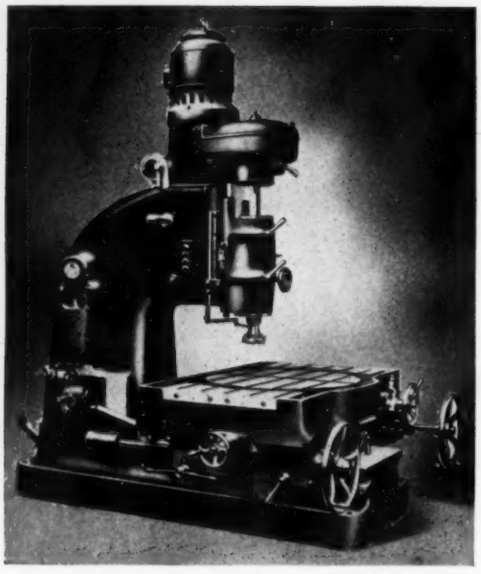


Right, third figure—The new speed change box used on the Nema-Neisse car-wheel lathe enables the operator to select the speeds needed without reference to speed tables. The large handwheel in the center has five positions which, in combination with three positions of the two levers at the right, give fifteen changes. The two handles at the left are for setting the machine to cut both straight and tapered threads, while the handle on the top of the box operates a disk clutch

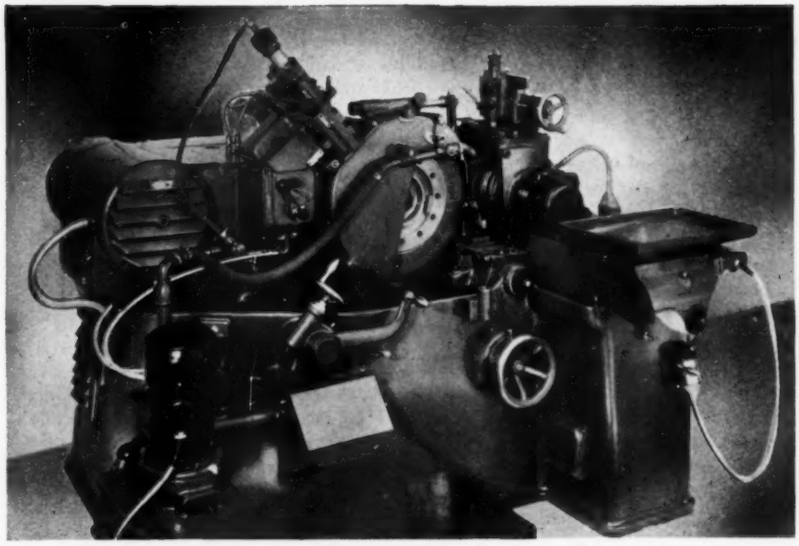


Below—Hille-Werke's (Dresden) precision boring machine may be used with either single or multi-point tools. Nine speeds are available when driven with a constant-speed motor through a built-in flexible-shaft drive. A counterweighted pilot bracket is adjustable vertically to suit the work. Depth may be controlled by an automatic stop set to a scale



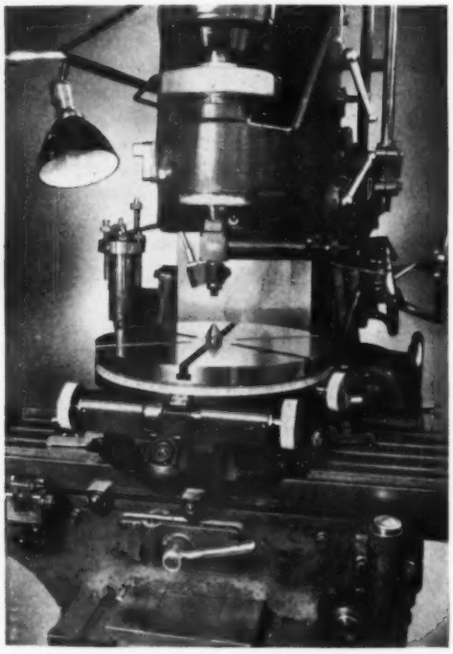


Left — A circular table with angular feed built into a rectangular table is a feature of this vertical milling machine by Muller & Montag, Leipzig. Pushbutton control is used with an excellent example of the flange-motor mounting so popular in Germany

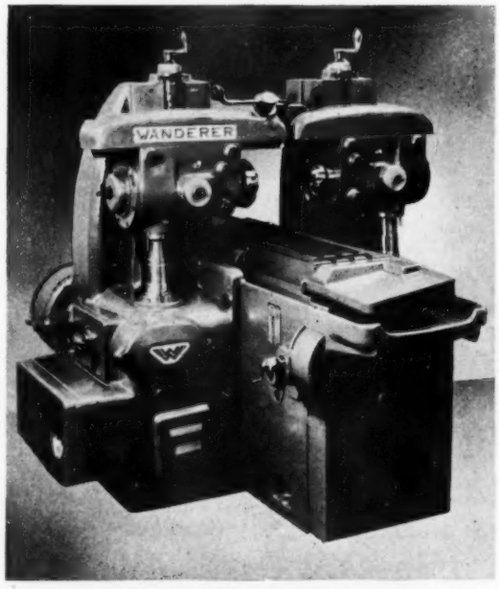


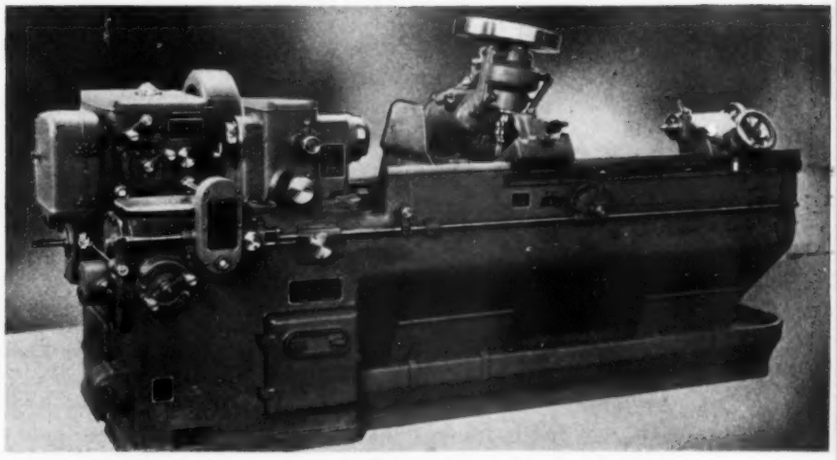
Above—Work can be centerless ground from 4 to 75 mm. in diameter, and cut off up to 200 mm. in length in this new machine by Hartex, Berlin. An adjustable support brings work pieces of different diameters into position quickly. The regulating wheel is worm driven and has eight feeds from 16 to 116 r.p.m. An automatic measuring instrument holds the work to within 0.0015 mm. in diameter. The wheel dresser is hydraulic

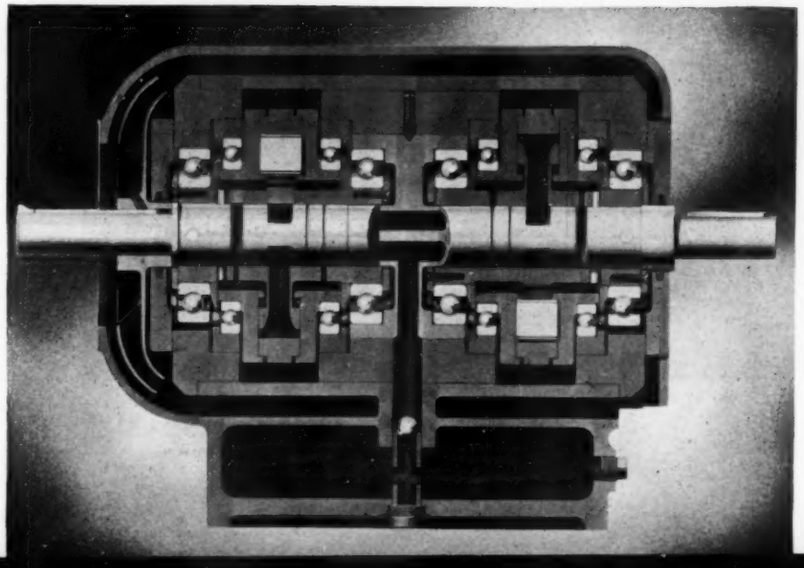
With this Carl Zeiss circular table for the jig borer, a microscope is supplied to center the table with the boring spindle



Left—Separate cutter spindle housings make it possible to furnish this Lincoln-type miller by Wanderer - Werke, Siegmar - Schönau, with either one or two heads or an extra-wide bed







Above—In this spline-milling machine by Pfauter, Chemnitz, the dividing-head and cutter spindles are driven from a single motor by V-belts. The cutter spindle has a flywheel to eliminate vibration. The work spindle is hollow to accommodate shafts of almost any length and has a tungsten carbide lining

Left—A hydraulic variable-speed box by Boehringer, Goppingen, has a driving pump which takes oil from a reservoir and forces it into an oil motor. The speed reduction depends on the ratio of the volume of oil delivered by the pump to that which the oil motor is set to receive. This box is said to be suitable for all kinds of machines requiring infinitely variable speed or torque and replaces the ordinary speed change box and friction clutch coupling. The oil pressure remains uniform at all times

selects cross, longitudinal, and vertical traverse, while another lever selects the table feed.

The lathes made by the same manufacturer have fully-inclosed feed boxes with lever positions indicated by color to show the corresponding steps on the feed chart. Metric, inch, or module threads may be set without the use of change gears. An oscillating relieving lathe is specially designed for use on rough parts. A new gang drill is arranged to have the spindle feed engaged automatically when the drill touches the work. Speeds may be set while the spindles are running and range up to 6,000 r.p.m. These machines may be used by hand, semi-automatically, or fully automatically as desired. They are also suitable for tapping.

Thread Milling

A short-thread miller for heavy work such as oil-well couplings was shown by Wandererwerke. This is a horizontal machine in which the work is set in the headstock and afterwards is fed by a leadscrew. When the machine is started, the cutter automatically feeds to depth and recedes. Rapid traverse is provided for moving the cutter into internal work. A special motor runs the spindle at a higher speed for centering the work. On ordinary threads, a hob is used but buttress threads can be cut by the employment of a disk cutter. The driving motor and feed gears are located at the tail end of the machine. In the duplex Lincoln-type miller made by the same concern, the overarms are arranged to be locked together for increased rigidity. This may be done even though they are set at different heights. The spindles on the Duplex machine are controlled independently as to speed and direction. An extra brace behind the overarm provides additional support. The tables available are 12 or 16 in. wide by 40 in. long.

On the spline-shaft grinder shown by Reinecker the truing device is arranged to take three surfaces of the wheel at one setting. The angular-head, planer-type miller made by the same concern has three heads each driven by an independent flange-type motor. This machine is called a "frame" milling machine and is specially suitable for machining engine castings. It may also be supplied with five cutting spindles. Built-in lighting fixtures are provided on the unit. A Reinecker automatic profile grinder has hydraulic feed and wheel truing. The tailstock is operated by a treadle, but this is locked in place when the work is under cut. The master templet is placed above the work piece.

Karl Jung showed a line of fully automatic internal grinders which rough, true, finish, and chuck with the operator doing unloading only. The truing device lies flat on the carriage and swings upward when in operation. These machines are fully hydraulic, with pushbutton control, and are obtainable in two sizes.

Hille-Werke showed small single-spindle honing machines suitable for work up to 3 in. in diameter, which is smaller than formerly obtainable. The feed is hydraulic and the stroke has a constant speed over its entire length. Shockless reversal is used. This manufacturer also displayed a precision horizontal boring machine for crankshaft bearings. This is arranged for the simultaneous fine-boring of multi-cylinder engines. The boring bar floats on adjustable supports.

On the engine lathes displayed by the Deutsche Niles-Werke the guides are halfway down the side of the bed, with a one-piece carriage. The front way is a V and two flat ways on the back of the machine, one above the other, prevent the carriage from lifting. The tailstock ways are on the top of the bed but do not run all the way to the headstock, which gives a wider swing near the chucking position. Drive is from a flange-mounted motor to an intermediate shaft on which extra gears may be mounted to give 24 geometric speeds instead of twelve.

A crankshaft bearing grinder made by Mayer & Schmidt had three automatic feeds on the grinding wheel slide. These provide fast approach, a rapid feed along the cheeks, and slow feed when the journal bearings are reached. V-belt drive and hydraulic feed to both wheel and table are used.

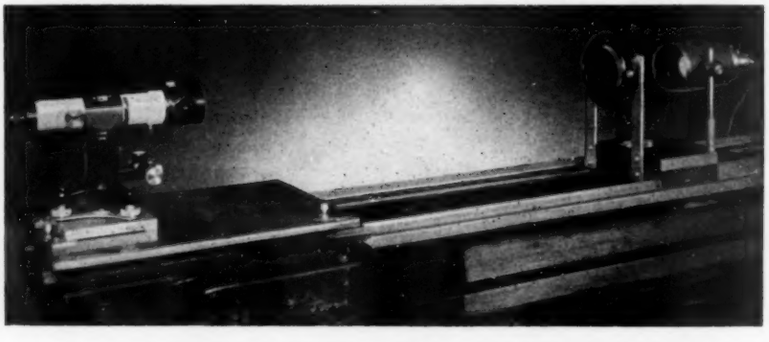
Hahn & Kolb displayed a double-ended boring machine with hydraulic table travel. This machine has two spindles at each end. A high-speed vertical tapping machine by the same maker is equipped with positive lead by means of gears.

Schiess-Defries showed the Fay automatic machine, which it is manufacturing under license of Jones & Lamson. This concern also displayed a crankpin turning machine in which the work remained stationary and is cut by a circular cutting head. It is said that the finish obtained by this machine makes it unnecessary to grind afterward. It is especially adapted to large gas and diesel engines. One signal light is provided to show that the electric circuit is in good condition, and another to show correct lubrication. A dial indicates the correct cutting speed for various diameters.

A line of radial drilling machines by Heller has stepless mechanical regulation of speed and feed. Arm clamping is hydraulically engaged and disengaged when the arm is raised or lowered. The column clamp is also hydraulic. The drilling head is provided with two dials, one showing the speed and the other the drilling pressure. Push buttons are provided for forward and reverse. The machines are rated by drilling pressure instead of drill size, the largest having a capacity of 6,600 lb. A line of cold saws by the same maker cut upward to place the cutting pressure downward on the ways. The spindle speed is stepless mechanically while the feed is hydraulic. A safety device is provided by which the feed is locked until the bar is securely clamped. These machines are also supplied to operate fully automatic ally. The PIV gear is used for the infinitely variable mechanical drive in the Heller machines.

The second and concluding article describing new German equipment at the Leipzig Fair will appear in an early number.

For use in setting up large machines, Carl Zeiss, Jena, is making an optical alignment tester consisting of a telescope, a target and a lamp for application to distances of 3½ to 120 ft.



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Editorials

Modernization Pays

A FORTNIGHT ago, on the Ford Sunday Evening Hour, W. J. Cameron said that his company had scrapped equipment worth $175,000,000 during the last eight years. He said further that it had been replaced by equipment costing $217,000,000, or approximately two and one-quarter millions each month.

These are large sums, but the principle behind them is more significant than the figures themselves. For this reason we are publishing the broadcast, in full, on the Talking Shop page. The principle, in brief, is that high wages and modern equipment are to be found together, and that the first is not possible, for any length of time, in the absence of the second.

The principle is by no means confined to the mammoth organizations in the Ford class. It holds equally in the shop employing only a few. Our leading article in this number is an account of its application in a shop employing but twenty-eight men. Seldom have we had such striking examples of the soundness of the modernization principle from the two ends of the scale, and we consider ourselves fortunate that both of them "broke" so that they could be included in one issue.

In a way the achievement of the smaller organization is the more striking despite the lesser sums of money involved. All of its equipment except one machine has been replaced in the last seven years, whereas the larger company has replaced but half of its equipment in eight years. It is not fair, of course, to hold this difference against the big organization. Much of its equipment is of an entirely different type than that used in the little shop. Each is so far ahead of the average plant, however, that it is practically in a class by itself. The main point is that both have prospered, and both have paid high wages.

LABOR is making astonishing strides in its efforts to organize hitherto unorganized industries and plants. It is insisting on higher wages and shorter hours, and getting them. We would be the last to object to a fair wage for labor and a reasonable working week. But we know that neither will come to stay as the result of political pressure alone. Both depend absolutely on providing the men in the plants with facilities that will enable them to produce more with less effort. The sooner everyone recognizes that fact, the sooner shall we have industrial peace and real prosperity.

Child Labor

THE CHILD LABOR amendment which has just been rejected so overwhelmingly by the New York State Assembly is an outstanding example of a bad way to do a good job. Now that the President's own state has turned it down the chances for its ultimate acceptance are poor.

Just because this particular amendment was badly drawn is no reason to abandon the fight against child labor. In fact, with it out of the way progress may be much faster. The National Association of Manufacturers has come forward with a plea to Congress to enact the Clark-Connery Bill now pending, but to make it more drastic. This bill would prevent the shipment of goods made by child labor into states where child labor is forbidden by law. The N.A.M. would control such goods at the point of origin, and would also broaden the descriptive phrase, "produced, manufactured or mined," to include "processed or extracted." This latter change is intended to cover the ninety per cent of goods not covered under the bill as written. Not more than one-tenth of all the child labor still employed is in the manufacturing industries.

Only sixty thousand children under sixteen are employed in these industries, but that is just sixty thousand too many. The N.A.M. recommendation should be pushed, and also its proposal that supplementary state laws with the same objective be passed.

CHIPS

WASHINGTON

President makes earnest plea for his plan to make the courts more "efficient," but with little effect on opposition which prepares to fight as hearings start in Senate Judiciary Committee . . . Joseph P. Kennedy appointed to head Maritime Commission on what he insists is a temporary basis . . . House starts debate on McReynolds neutrality measure which gives the executive arm more discretion than the companion Pittman bill passed by the Senate . . . Bar associations of all states vote against Roosevelt court plan . . . Wheeler committee recommends steps to bring railroad holding companies under I.C.C. . . . Administration is trying to work out a labor policy to prevent the strikes that are crippling Detroit and other centers of industry . . . Social Security clerks have listed 25,000,000 . . . 13 steel companies bid on Navy inquiries, all complying with Walsh-Healy restrictions . . . Railway executives and labor chiefs agree on new pension plan to remove men from social security ranks.

FOREIGN

Japan party leader warns against policy like that which led Germany into World War . . . France floats 10,000,000,000-franc defense loan; it is oversubscribed . . . Defense programs boost world prices of wheat and copper . . . Nazi decree threatens foreign holdings and nationals in emergency, planned as retaliatory measure . . . Great Britain will protect overseas possessions and trade routes, says Hoare . . . Rising prices of tin and rubber controlled by Great Britain, consumed largely by U. S., lead to conversations between Eden and Ambassador Bingham . . . Hull protests obscene attacks on LaGuardia in official Nazi newspapers . . . Italian reprisals may lead to prolonged guerilla warfare in Ethiopia . . . French government takes over Le Creusot munition plant in nationalization move, will compensate owners . . . Japanese army is withdrawing from Manchuria . . . Balbo says Italy is a Moslem power . . . British commodity prices continue to rise . . . Japan's new foreign policy revives talk of trade treaty here.

FINANCE

Prices of government bonds decline as market has violent flurry . . . Mariner Eccles suggests that a rise in taxes now would go far to avoid runaway inflation later, says he is against a "tight money" policy, wants production increased and prices kept down; Doughton says no new taxes are needed . . . 33⅓ per cent increase in income taxes expected, total likely to exceed three billion.

INDUSTRY

Lewis moves to set up C.I.O. as a rival labor group and makes plans to charter affiliates, prepares for major attack on textile industry with oil next in line . . . A. F. of L. prepares to change suspension of C.I.O. units to expulsion . . . Barring of Chrysler executives from their offices by strikers changes contemplated mild policy into legal suit against Lewis and other C.I.O. and U.A.W.A. leaders, court orders strikers to vacate but they refuse . . . M.I.T. plans training course for young business and industrial executives . . . New York legislature refuses approval of Child Labor amendment despite orders from Roosevelt and Farley . . . Freight yards at Eastern ports clogged by shipments of scrap iron waiting cargo space to European munition plants . . . G.M.-U.A.W.A. conference bogs down as corporation complains of 18 new strikes in 20 days but finally reaches agreement . . . Chicago's Loop gets a taste of sit-down strikes . . . Briggs and other plants close as Chrysler orders stop . . . Remington-Rand and A. F. of L. unions reach tentative agreement to end long strike . . . Exide Battery union workers switch from A. F. of L. to C.I.O. . . . Sit-down strikes close Detroit hotels for a day and fears of a general strike are expressed.

INDICATORS

Steel production at practically 90 per cent of capacity . . . Electric power output increases . . . Business Week's Index drops a point to 79.3.

WATCHING *Washington*

Congressional fear of sitdown strikes becomes vocal . . . Pending Wagner Act decision holds up labor policy of government . . . Justices may speak minds on court revision . . . Corporate surplus tax modification urged

WASHINGTON—Alarmed by the wave of sit-down strikes throughout the country, Senators and Representatives are kicking over the traces and declaring against the illegality of labor's newest weapon. They fear an increase in lawlessness and want the contagion of such strikes to be stopped. Senators Johnson, Lewis and King were the first to speak out, catching administration men off guard. Democratic floor leader, Senator Robinson, issued a statement agreeing that sit-downs are illegal, but insisted Congress can do nothing now. In his opinion progress in making peace between capital and labor cannot be made until the Supreme Court acts on the Wagner Labor Relations Act. The court has recessed until March 29 without taking action.

Renewed Attacks on Sitdowns

Failure to rule on the act is not hampering the administration in settling labor disputes, according to Senator Bailey, one of several who burst out with renewed attacks on sitdowns and their effects. Charges filled the air that President Roosevelt is taking orders from John L. Lewis, that Mr. Lewis is a "traitor" if he is responsible for the sit-downs, that the sit-down is "anarchy in its worst form," and that "monopoly" must take part of the blame. Senator Borah is responsible for the last charge and said further that until monopoly is curbed there will be no solution to the problem.

"As matters now stand," declared Mr. McGrady before the American Industrial Development Council, "the decisions of the Supreme Court make the formulation of an effective national policy (on labor) almost impossible." He was certain, however, that governmental assistance in getting the two sides together in working out a program is essential.

Later it was revealed that a rough draft of a labor policy has been prepared by the administration to be submitted to Congress after the fight over the revision of the Federal judiciary system is settled. An appeal board functioning under the Department of Labor is envisioned. One spokesman went so far as to say that the proposed law would probably give management and labor the right to organize within a given industry. If the two could not agree over differences, labor would be bound not to strike, pending submission of the dispute to the labor commission. If its findings were unacceptable, the report thereof would be made public. The idea behind the proposed law is that publicity is considered sufficient to prevent a strike and that public sentiment would "afford some sort of punishment in event the public found either side to be in the wrong."

The National Labor Relations Board has handed down a 50,000 word decision asserting "wholesale violations" against Remington-Rand, Inc., and has ordered that 4,000 strikers from the May 26, 1936 strike be rehired. After refusing to rehire the strikers, Remington-Rand, through James H. Rand, Jr., president, entered into a tentative agreement with A.F. of L. unions represented by William Green, A. O. Wharton, and John Frey. The meeting took place in the office of Secretary of Labor Perkins, but the terms were not made public. After the announcement of an agreement, the plant councils of the Remington Rand plants protested to N.R.L.B. against the rehiring order, asserting that the plants had been fully manned for months and many council members would be dismissed.

The Supreme Court will not be called upon to decide the constitutionality of the Railroad Retirement Act now that a new agreement has been entered into voluntarily by railroads and the 21 railway unions. The new retirement pension plan will go into effect after Congress enacts two bills; it will place railroad workers on a better plane than the Social Security Act provides for industrial employees. Maximum pension is to be $120 per month as against $85; death benefits 4 per cent of earnings as compared with 2½ per cent, but the payroll taxes start at 5 per cent and go up to 7 per cent after 12 years, borne equally by employer and employee.

Justice McReynolds' extemporaneous suggestion before a fraternity banquet that "good sportsmanship" should indicate aceptance of a decision before a "fair tribunal" has aroused considerable discussion throughout the country. Opponents of the court revision plan are endeavoring to get other justices to state their opinions. Senator Ashurst, chairman of the Judiciary Committee, has said that no official invitations would be given to the justices to come before the committee, unless they indicated a desire to do so "in writing." There is still some talk of an amendment to clarify Congress' power to enact social and economic legislation, but Senator Robinson has made it clear that it would not be a substitute for the President's plan.

Higher Taxes Disputed

Rumors still persist that we shall see higher taxes despite assurances by finance committee chairman in the House and Senate. Representative Doughton and Senator Harrison have both said that higher levies will not be needed. They pointed to larger income tax returns than anticipated and did not agree with Marriner S. Eccles, chairman of the Federal Reserve Board, who had proposed tax increases in order to prevent inflation by balancing the budget, covering the relief burden and cutting the debt.

Blows Hot and Cold

After Administration pressure had won sweeping victories for John L. Lewis in motors and steel, and started a wave of sitdown strikes, the President told a group of House members that sitdown strikes were not only illegal but a menace! Despite rumors, he will not propose any plan of compulsory arbitration for industrial disputes, but will rely on machinery similar to the National Mediation Board for the railroads. Pro-labor legislation remains sidetracked while the battle rages over the enlargement of the Supreme Court.—*Carter Field, Washington Bureau, McGraw-Hill Publishing Co.*

Index of Machine Tool Orders

Based on Volume of Shipments for 1936

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1936 — March	89.0	16.3	105.3	109.4	15
April	110.9	14.8	125.7	114.4	12
May	95.7	23.2	118.9	116.6	19
June	106.5	22.3	128.8	124.4	17
July	104.4	45.7	150.1	132.6	30
August	96.1	31.4	127.5	135.5	24
September	82.9	35.6	118.5	132.0	30
October	105.4	31.1	136.5	127.5	23
November	110.7	36.4	147.1	134.0	25
December	205.7	52.0	257.7	180.4	20
1937 — January	156.1	44.0	200.3	201.7	22
February	122.4	42.8	165.2	207.7	26

Distribution of Orders

Average Indexes of Individual Companies Based on 1926 Level of Business	Companies in Per Cent of Total Number Reporting: 1936 1st Quar.	1936 2nd Quar.	1936 3rd Quar.	1936 4th Quar.	1937 Jan.	1937 Feb.
200-up	13.0	17.2	15.8	28.4	35.1%	24.4%
100–199	24.6	32.6	28.8	30.2	30.6	33.6
60– 99	22.4	19.0	22.9	19.5	14.2	21.4
20– 59	26.5	21.8	21.7	15.2	13.4	12.2
Less than 20%	13.5	9.7	10.8	6.7	6.7	8.4

Industrial Review

• DESPITE the disturbing effects of labor troubles, long deliveries, and price uncertainties caused by inflation, machinery and machine tool business improved in most of the industrial centers in March. There is beginning to be talk of accepting machine tool orders on the basis of the current price at date of delivery. In one or two instances orders have been taken with the guarantee that the price would not be more than 12½ per cent higher at the time of delivery. Fear of the disturbing effect of the sit-down strike has made some buyers reluctant to place orders for much needed equipment.

• IN THE EASTERN territory as a whole March business is expected to exceed the February level although New England distributors note that the fear of labor trouble is postponing orders that should be placed at once. March business in Pittsburgh is going to be definitely better than February business and there is at least a good chance that it will reach the high record made at the end of the year. Avoidance of a prolonged steel strike is largely responsible. Cleveland is still going ahead at a satisfactory rate although some of the automobile parts companies are in trouble because of the shutdown of car plants in Detroit.

• AS THIS IS WRITTEN the threat of a general strike in all automobile and parts plants in Detroit is hanging over the heads of business men and is operating very effectively to stifle enterprise. Labor troubles are also affecting business in the Toledo and Indianapolis territories although in both of these cities there is little local difficulty.

• ORDERS FOR machine tools have fallen off in the Cincinnati district because of uncertainties in other territories but the trade generally has a backlog that will last for several months. Sit-down strikes are spreading in the St. Louis territory and are hampering business. Even so, March will be a good month in the machinery trade. In Chicago, on the other hand, the strikes do not seem to have interfered with the placing of machinery orders. March is expected to equal or possibly surpass February. The same is true in Milwaukee where the only drawback is the lack of the usual orders from the automobile centers.

• MACHINE TOOL orders dropped off somewhat on the Pacific Coast during the past fortnight due probably to two factors: First, sit-down strikes in the Los Angeles area, particularly in airplane plants; Second, a hold-over effect of the maritime strike. The present outlook, however, is reported good.

Machine Tool Orders Are Above the Average for 1936

Although the February machine tool orders fell below those of the preceding month, they are well above the average for the preceding year. Indications are that the general upward trend is not over and that the present three months moving average of 207.7 represents the passing of a temporary top in the market.

It will be noted that the greatest change in distribution of orders occurred in those companies which have the higher indices. Some rearrangement has taken place since January in that only one-quarter of the companies now have double the business of 1926 and an increasing number have stepped up to equal or better business than previously enjoyed.

Foreign orders have increased 6 per cent during the past month and represent a higher percentage of the total business done than at any time in the past six months. The index of foreign orders is now 170 per cent of the average for the previous year.

Brown & Sharpe Graduate Apprentices Meet at Banquet

The first general gathering of graduate apprentices of the Brown & Sharpe Mfg. Co., was held in Providence, R. I., on Thursday, March 11. There were about 300 graduate attending, of which approximately 100 are now located outside of the Brown & Sharpe plant. Many of these men now hold executive positions in industries throughout the country.

David Arnott, Brown & Sharpe Mfg. Co., gave the welcoming address. Benjamin P. Graves, director of design, was toastmaster. The principal speaker of the evening was Ralph E. Flanders, president of the Jones & Lamson Machine Co., Springfield, Vt. Addresses were made by the guest speaker, Judge Ira Lloyd Letts, and by Henry D. Sharpe, president and treasurer of the Brown & Sharpe Mfg. Co.

Russian Machine Tool Output

According to the 1936 Plan, 23,500 machine tools were to be produced, but production through September aggregated 16,567 machine tools, or 70.5 per cent of the proposed annual output. This output represents a 27 per cent increase over production in the corresponding period of 1935, according to the American Consulate at Moscow.

Detroit LETTER

Industry wide equipment buying on unusual scale is in prospect . . . Chevrolet engine plant projected for unknown location . . . Canadian officials demand that more parts be made there . . . Truck diesels due in '38

DETROIT—Although union warfare has cast an ominous shadow over Detroit, with the present situation closely akin to anarchy, it has not entirely obscured the fact that the motor industry has under way some hefty plans for equipment buying. Scarcely ever has the volume of potential business looked so promising. Perhaps the most encouraging feature is that prospective purchases will be on an industry-wide scale. In some cases the number of inquiries has been embarrassing because it is almost impossible for machine builders to keep abreast of them.

Not the least interesting development is the serious consideration which Chevrolet is giving to building a new engine plant outside of Flint. A year or more ago Chevrolet thought of locating a motor factory on the West Coast, possibly at Oakland near its assembly plant, but that plan was held in abeyance. Recently it has taken estimates on machinery for a plant with a capacity of 75 to 80 motors an hour. It is not known whether the proposed plant will be in California or in some other part of the country; in fact, a final decision has not yet been made on whether to proceed with the program.

More Decentralization?

Good judgment would seem to dictate a decentralization of engine manufacture, and that is exactly what Chevrolet has in mind. If the proposed plant is erected, it will be only the beginning of the exodus from Flint. If after a year's operation the new plant should be a huge success, other regional engine plants might be established.

Cadillac is expected this week to spend about $250,000 for new machine tools for the cylinder block, crankshaft, connecting rod and piston lines for its V-eight car. For the past two years there have been rumors that Ford would make a major outlay for tool and die shop equipment. Actually the program is just now getting hot. It is reported the tool and die room in B building at the Rouge plant will be moved elsewhere and inquiries have gone out for a long list of tools, including lathes, shapers and surface grinders. This appears to be the biggest toolroom buying by Ford since 1932.

Equipment for Canada

The program at Chrysler of Canada is at the white-heat stage. The complete new engine plant there will mean an expenditure of about $2,250,000, but whether purchases will be authorized before the Chrysler strike in Detroit ends is problematical. Machine builders can look confidently to Canadian subsidiaries of the automobile companies for substantial business in the next year or two. The Canadian government is bent on raising drastically the Canadian content of cars built in the Dominion. To that end it is understood that representatives of Ford, General Motors and Chrysler were called to Ottawa the past week for a conference with high Canadian officials. Within the next year Chrysler and General Motors must raise their Canadian content to 60 per cent and a year later to 75 per cent, especially if they wish to compete in the overseas markets of the British Empire. Ford of Canada already has a Canadian content of 75 per cent, hence is able to get into lucrative markets, such as New Zealand, where its competitors are virtually barred by restrictive rules. Further expansion at General Motors of Canada as well as at Chrysler appears in order.

Factories having plans under way for purchase of new equipment to enlarge productive capacity are Oldsmobile, Pontiac, Chrysler-Jefferson Avenue and Plymouth. Fisher Body has acquired a plant at Ionia, Mich., from the Ypsilanti Reed Furniture Co. which is to be operated in conjunction with its Grand Rapids stamping plant for fabrication of seats and body trim. It is no secret that Fisher Body has long debated the advisability of putting a stamping plant in the East to serve General Motors assembly plants.

Diesels for heavier trucks, beginning with the 1½-ton capacity, are assured for the '38 season. Diamond T, with its Hercules-motored trucks, can claim the distinction of being the first truck company to put diesel-engined jobs on a production basis. Chrysler is ready to give the "go ahead" for the manufacture of its own diesel, a six-cylinder unit. It is likely to be made at the Dodge plant and will be put into the heavier type of Dodge trucks. Tooling up for this engine will not involve much new machinery. Production at first will be small.

General Motors too, despite its repeated statements that the time hasn't yet come for an efficient automotive diesel, is preparing to make diesels for trucks, possibly both for Chevrolet and General Motors Truck.

Automobile Production

Badly disrupted by strikes, automobile production is holding its own compared with a year ago. Chrysler, Hudson and Reo are closed by sit-down strikes. General Motors is making cars at the rate of about 50,000 a week and W. S. Knudsen declares it will take four months for the corporation to catch up with its orders. Chevrolet will sell around 125,000 cars at retail this month and Buick expects the next 60 days to be the best in its history. It still thinks it can reach the quota originally set of 225,000 cars during the current model year. Willy-Overland is down temporarily until it can get deliveries of parts from strike-bound Detroit.

Edward P. Burrell Dies

Edward P. Burrell, since 1924 director of engineering for Warner & Swasey Co., and nationally known engineer in the astronomical field, died March 21. An extended obituary will be published in the next issue.

Measured Day Work Will be a Topic at A.M.A. Production Meeting in Chicago

Manufacturing executives will hear a program based on a survey of most pressing problems before industry now

The Production Executives Division, American Management Association will hear six well-known men discuss better understanding between management and men, "measured day work", production control, job training and kindred subjects at the two-day ann ·l session of the group in Chicago, April 21-22. The Palmer House has been selected for the meeting. Earl M. Richards, assistant to the vice-president, Republic Steel Corp., is in charge of the program.

The first paper "Means of Obtaining Better Understanding Between Management and Men" by Charles M. White, vice-president in charge of operations, the Republic Steel Corporation, will throw light on a number of questions that are plaguing industry at the present time. In particular he will talk on putting the company's problems before the men, combating destructive attitudes and reaction, and also making collective bargaining a fair, flexible and satisfactory way of securing understanding between men and management.

Another subject which is coming to the fore is "measured day work" on which Wm. W. Gumprich, manufacturing engineer, the International Business Machines Corporation, will speak. Mr. Gumprich will attempt to answer the questions whether piecework and bonus will be abandoned by industry, and what methods are used to produce the highest possible efficiency with measured day work.

Thomas Turner, general superintendent, the Newark Div., Westinghouse Electric & Mfg. Co., will talk on "How Can the Training of Skilled Men be Accelerated? The Depression Severely Curtailed the Development of Skilled Help." In addition, Frederick Oakhill, of Bauer & Black, Inc., Chicago, has been assigned the subject "How Can Maintenance Costs be Controlled?"

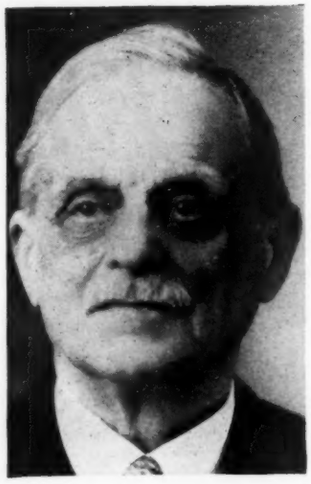
Mr. Richards is organizing a session on methods of giving the executive an up-to-the minute picture of what happens in his plant.

Exports of Machinery During January, 1937

	January 1937	December 1936	January 1936
Electrical machinery and apparatus	$7,471,528	$8,214,395	$6,037,034
Power generating machinery (except automotive and electric)	1,200,987	921,089	937,519
Construction and conveying machinery	1,201,130	862,301	660,934
Mining, well and pumping machinery	4,565,500	3,503,585	2,668,095
Power-driven, metal-working machinery	4,314,629	3,913,820	3,947,706
Other metal-working machinery	270,877	276,250	729,901
Textile machinery	673,937	803,263	1,488,229

Exports of Metal-Working Machinery During January, 1937

	January 1937	December 1936	January 1937
Engine lathes	$256,935	$203,803	$291,299
Turret lathes	259,696	276,064	110,122
Other lathes	139,076	145,403	151,839
Vertical boring mills and chucking machines	164,765	128,008	139,865
Thread cutting and automatic screw machines	257,073	262,036	191,721
Knee and column type milling machines	221,431	178,067	72,590
Other milling machines	283,621	365,732	251,517
Gear cutting machines	106,925	120,893	330,432
Vertical drilling machines	249,315	201,130	58,883
Radial drilling machines	30,551	10,718	20,670
Other drilling machines	176,130	118,328	109,640
Planers and shapers	70,445	33,761	83,703
Surface grinding machines	115,276	151,799	115,214
External cylindrical grinding machines	101,257	97,679	176,886
Internal grinding machines	110,853	129,185	154,543
Tool grinding, cutter grinding and universal grinding machines	105,257	160,540	194,202
Other metal grinding machines	109,341	85,993	67,908
Sheet and plate metal working machines	408,185	203,658	111,825
Forging machinery	139,301	180,742	285,726
Rolling mill machinery	251,836	142,979	160,940
Foundry and molding equipment	147,571	100,984	556,093
Other power-driven metal-working machinery and parts	609,789	616,318	312,088
Other Metal-Working Machinery			
Pneumatic portable tools	118,503	101,944	51,346
Other portable and hand and foot operated metal working machines and parts	70,524	70,692	51,001
Chucks for machine tools	17,774	20,820	12,661
Milling cutters, machine operated threading dies and taps and similar machine-operated metal cutting tools	32,433	44,506	569,906
Other metal-working machine tools	31,643	38,288	44,987



Elihu Thompson, Pioneer In Resistance Welding, Dies

Professor Elihu Thompson, one of the founders of the General Electric Company, died a his home in Swampscott, Mass., on March 13 at the age of 83. He has been seriously ill since January. Funeral services were conducted in Lynn, Mass. Honorary pallbearers included many prominent men from the electrical and other industries as well as from educational circles.

Elihu Thompson was one of America's greatest pioneers in the field of electrical science. His technical work was directly reflected in practical developments. He originated the resistance method of electric welding, which has been in continuous use from 1887 to the present time. He was one of the early arc light inventors and experimented with the principal of alternating current transmission far in advance of commercial demand. He also developed the repulsion type of induction electric motor, invented the constant-current transformer, and the modern process of commercially treating fused quartz. The number of patents which he held in the United States alone numbered almost 700.

Professor Thomson's name was given to the Thomson-Houston Electric Company organized in 1883, and merged in 1892 with the Edison General Electric Company to form the General Electric Company of today. He has ever since been associated with General Electric and at the time of his death was dean of that company's staff of scientists. For more than fifteen years he was director of the Thomson Research Laboratory, located at the River Works of the Company at West Lynn, Mass.

Manages Una Welding

W. K. COOPER

Heads Sales Activities

A. A. PROBECK

New Chief Engineer

R. B. FEHR

PERSONALS

W. K. COOPER, formerly assistant general manager of the New York Shipbuilding Corp., is now vice-president and general manager of Una Welding, Inc. Previously he was connected with the Spicer Manufacturing Corp. in an executive capacity. R. B. FEHR, the new chief engineer, has had considerable arc-welding experience in the last fifteen years with the Rail Welding & Bonding Co. of Cleveland, and as technical director for Gear Processing, Inc., Detroit and Cleveland.

A. A. PROBECK is now vice-president and sales manager of Una Welding, Inc., Cleveland, Ohio, manufacturers of arc welders, automatic equipment and welding rods. Mr. Probeck began his career in the arc welding field 25 years ago with the old C & C Electric Co., Garwood, N. J., and for many years was connected with the Federal Machine & Welder Co., Warren, Ohio. From 1927 and 1931 he was connected with Una Welding, but then returned to Federal Machine & Welder Company in an executive capacity. He now has returned to Una Welding as vice-president and manager.

RAYMOND W. YOUNG, assistant engineer, Wright Aeronautical Corp., Paterson, N. J., was awarded the 1936 Manly Memorial Medal at the National Aeronautic Meeting of the Society of Automotive Engineers, March 12. Mr. Young was given the medal for his paper "Air-Cooled Radial Aircraft Engine Performance Possibilities," presented before the Society's annual meeting, January 17.

R. B. TEWKSBURY, formerly president of the Oster Manufacturing Co., Cleveland, manufacturers of pipe and bolt threading equipment, is now chairman of the board. ROGER TEWKSBURY, formerly vice-president, is now president and treasurer, and ARTHUR S. GOULD, formerly secretary, is now vice-president. HARRY A. MAURER was elected secretary. He was previously general superintendent of the company's plants at Erie, Pa., and Cleveland, Ohio.

DONALD G. MILLAR, chairman of the board of trustees of the Greenfield Tap & Die Corp., Greenfield, Mass., for the past two years, has been elected president of the corporation to succeed COL. FREDERICK H. PAYNE. Col. Payne again assumes the chairmanship of the board.

A. VAN HASSEL has been elected president of the Magor Car Corp., Passaic, N. J., to succeed R. J. MAJOR, who will continue as chairman. Mr. Van Hassel was formerly vice-president and treasurer. L. C. HAIGH, formerly secretary and J. W. LEIS, formerly plant manager, have been elected vice-presidents.

E. J. CYR, general foreman at Chicago, for the Chicago, Burlington & Quincy Railroad has been made master mechanic of the McCook division, with headquarters at McCook, Nebr. Mr. Cyr succeeds C. J. DIETRICH who has gone to the Alliance Division.

CAPTAIN WILLIAM G. DUBOSE, U. S. Navy, has been appointed Chief Constructor and Chief of the Bureau of Construction and Repair with the rank of Rear Admiral. He replaces REAR ADMIRAL EMORY SCOTT LAND, retired.

NELSON T. HASENFLUE has been elected secretary and general manager of the Par-Brook Mfg. Co., Cleveland, manufacturers of sheet metal products, to succeed the late GEORGE F. COLLISTER. Mr. Hasenflue was secretary-treasurer and general manager of the Champion Hardware Co.

DEL S. HARDER has been named general factory manager for all fabricating divisions of the Fisher Body Division of General Motors Corp. GLENN S. CASHDOLLAR, former resident comptroller, succeeds him as resident manager of the Grand Rapids Stamping Division of the corporation.

AUBREY R. GOODWIN has been appointed manufacturing engineer of the Radio Division, General Electric Co., Bridgeport, Conn. Mr. Goodwin will be in charge of all receiver and other allied radio manufacturing operations.

REAR ADMIRAL ANDREW C. PICKENS, U. S. Navy, Chief of Staff of Commander-in-Chief, United States Fleet, is to relieve REAR ADMIRAL STARK as Chief of the Bureau of Ordnance according to naval orders just released.

A First Copy of the American Machinist Available

Wm. Sachs, El Paso Vocational School, 100 W. Rio Grande St., El Paso, Texas, has informed us that he has a copy of *American Machinist* Volume I, No. 1 which he is willing to dispose of. If any reader of this item is interested he should communicate directly with Mr. Sachs.

JAMES ALLISON, formerly field service metallurgist for the Union Drawn Steel Company in New York and New England areas has become factory manager for the Billings & Spencer Co., Hartford, Conn. He is a member of the American Society of Metals, having served as chairman of the Hartford Chapter in 1933-34.

ROBERT F. VOGT, assistant chief consulting engineer of the Allis-Chalmers Manufacturing Co., has been made chief consulting engineer to succeed the late J. F. MAX PATITZ. Mr. Vogt has been with Allis-Chalmers since 1907.

MEETINGS

AMERICAN FOUNDRYMEN'S ASSOCIATION. Annual convention and exhibit, Milwaukee Auditorium, Milwaukee. May 3-7.

AMERICAN MANAGEMENT ASSOCIATION. Annual production executives meeting. Palmer House, Chicago. April 21-22. Alvin E. Dodd, president, 330 West 42nd St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semi-annual meeting. May 17-21. Statler Hotel, Detroit. C. E. Davies, secretary, 29 W. 39th St., New York.

ASSOCIATION OF AMERICAN RAILROADS, MECHANICAL DIVISION. Annual meeting, Municipal Auditorium, Atlantic City. June 16-23.

CHAMBER OF COMMERCE OF THE UNITED STATES Twenty-fifth anniversary meeting. Washington, D. C. April 26-29. D. A. Skinner, secretary.

KNITTING ARTS EXPOSITION. Commercial Museum, Philadelphia. April 19-23. A. C. RAU, secretary, 327 Park Square Bldg., Boston.

SOUTHERN TEXTILE EXPOSITION. Textile Hall, Greenville, S. C. April 5-10. William G. Sirrine, president, Textile Hall Corp., Greenville.

PATENTS

Metal-Working Machinery

Duplicating Machine. Einar K. Johansen, Chicago, Ill., assigned to Clearing Machine Corp., Chicago, Ill. Patent 2,072,336.

Jigsaw. Julius C. Lowry and Ora M. Rybolt, Detroit, Mich., assigned to Magnetic Tool Co., Inc., Detroit, Mich. Patent 2,072,590.

Drill Press Spindle Drive and Mounting. William Ferdinand Ocenasek, Plainfield, N. J., assigned to Walker-Turner Co., Inc., Plainfield, N. J. Patent 2,072,646.

Swaging Machine. Neal T. McKee, Bronxville, N. Y., assigned to The Superheater Co., New York, N. Y. Patent 2,072,680.

Parts and Mechanisms

Press System (Hydraulic). Thomas F. Stacy, Piqua, Ohio, assigned to The French Oil Mill Machinery Co., Piqua, Ohio. Patent 2,072,141.

Reverse Gear. Carroll E. Marshall, Richmond, Calif. Patent 2,072,174.

Spring Nut Lock. George E. Monroe, Detroit, Mich. Patent 2,072,176.

Feed Mechanism for Machine Tools. John R. Johnson, Rockford, Ill., assigned to The Ingersoll Milling Machine Co., Rockford, Ill. Patent 2,072,340.

Fluid Motor for a Power Transmission Mechanism. Walter M. Braly, Louisburg, Kans. Patent 2,072,356.

Press System (Hydraulic). Thomas F. Stacy, Piqua, Ohio, assigned to The French Oil Mill Machinery Co., Piqua, Ohio. Patent 2,072,488.

Grinding Machinery (Spindle Mounting). Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Inc., Cincinnati, Ohio. Patent 2,072,814.

Tools and Accessories

Flaring Tool. August C. Dobrick, Chicago, Ill., assigned to The Imperial Brass Mfg. Co., Chicago, Ill. Patent 2,072,359.

Portable Electric Tool. Frithiof P. Forss, Aurora, Ill., assigned to Independent Pneumatic Tool Co., Chicago, Ill. Patent 2,072,551.

Blowpipe. Lloyd W. Young, Buffalo, N. Y., assigned to Union Carbide and Carbon Corp., New York, N. Y. Patent 2,072,626.

OBITUARIES

Developed Machine Tools

ROBERT T. HAZELTON

ROBERT THOMPSON HAZELTON, treasurer and works manager of the Cincinnati Shaper Company for 18 years, died of a heart attack on March 3. He was known throughout the country for his designing and development of machine tools. Mr. Hazelton was born in 1883 at Petosky, Michigan, was educated in Rochester, N. Y., and entered the employ of the Bridgeford Lathe Company at Rochester. He went to Cincinnati in 1911 and was associated with the Cincinnati Milling Machine Company. In June of 1920 he joined the Cincinnati Shaper Company.

CHARLES WESLEY, SR., president of the Wesley Steel Treating Co., Milwaukee, died March 3. He established the business in 1915 and his son CHARLES I. WESLEY is vice-president and general manager.

BUSINESS ITEMS

The American Institute of Bolt, Nut & Rivet Manufacturers has moved to 1550 Hanna Bldg., 14th and Euclid Aves., Cleveland, Ohio.

The Ajax Flexible Coupling Co., has moved its Pittsburgh sales office to 970-B Union Trust Bldg. J. GUY GRIFFITH is the representative.

The Bantam Ball Bearing Co., South Bend, Ind., has changed its name to describe more clearly its present day production. The new name is the Bantam Bearings Corporation, and the company is a subsidiary of the Torrington Co., Torrington, Conn.

The Boyar-Schultz Corp., Chicago has, since February, manufactured and distributed the copper head laps acquired from the Groetchen Tool & Manufacturing Co., also of Chicago.

The Greenfield Tap & Die Corp., has leased space for a New York sales office on the 46th floor of the RCA Bldg., in Rockefeller Center, N. Y., and is now occupying the new quarters.

E. Leitz, Inc., has moved from 60 East Tenth St. to the Heckscher Bldg., 730 Fifth Ave., New York. The new quarters are well suited for the company's business in microscopes and other optical instruments.

Pangborn Corp., Hagerstown, Md., manufacturer of blast cleaning and dust collecting equipment, is making extensive additions to its plant. An expenditure of approximately $80,000 is planned for the building and new equipment.

The Monarch Machine Tool Company, Sidney, Ohio, has recently let a contract for the addition of approximately 18,000 sq. ft. of floor space to its machining division. It is expected that the building will be ready for occupancy about April 1. At that time, $100,000 worth of new machine tool equipment which is now on order will be installed. The new arrangement will allow more satisfactory arrangement of machine tools and materially increase production.

The Carboloy Company, Inc., Detroit, announced that effective March 22, its Chicago office has supplemented its service with an additional midwest representative, F. J. STAROBA. Mr. Staroba will cover the district comprising Southern Illinois, Missouri, and Kansas. He replaces Mr. Deeds who is being transferred to the Indiana and Kentucky district.

Suggested Speeds for Tungsten-Carbide Drills

BECAUSE of their construction, tungsten-carbide-tipped twist drills are not usually recommended for hard materials. They are, however, well adapted for drilling highly abrasive materials and materials of low strength such as concrete, bakelite, hard rubber, slate, stone, glass, carbon, copper, graphite alloy, and similar materials.

Recent information from the Cincinnati-Bickford Tool Company lists the following cutting speeds which have been successfully used for the materials listed:

Materials	*Suggested Speed Ft. Per Min.*
Slate	40
Marble	60 to 80
Sandstone	30
Glass	20 to 30
Pure carbon	100
Copper graphite alloy	60 to 70

Very light feeds are recommended for these materials.

Oversized Taps

C. G. WILLIAMS

WHY BUY oversized taps at all? E. G. Marshall suggests their use (*AM*—Vol. 80, page 257) in die work, and Stanley Baldwin asks how they can be furnished when the O.D. tolerance of unground taps is only 0.001 to 0.0025 in. (*AM*—Vol. 80, page 1048).

If either of these men will use heavy oil on the tap, the tap will cut oversize to such an extent that the bolts will fit even after the part has been hardened. Another way would be to screw slugs of soft steel into the holes before hardening. These would expand the holes when the piece is heated, and the holes will not contract as much as if they were left open. Moreover water cannot get in. If the holes are not plugged, the surrounding metal expands and reduces the size, and then when hardened, this metal is chilled, retaining the reduced size. The result is a small and oftentimes drunken thread.

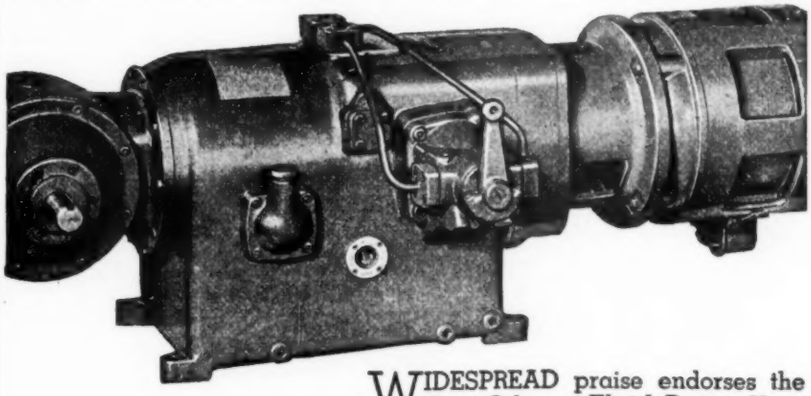
Scrapping Men or Machines

AN UNUSUALLY successful superintendent of a large shop writes us about the scarcity of skilled men as follows:

"It pleases me to note the troubles some industries are running into with a scarcity of skilled labor after many of them have discharged their men as being too old at fifty. I know of machinists who were discharged on account of age who were doing far more work in their last days than the young man who displaced them were doing two years later. Many of these people would not think of throwing out a machine as long as it could be pepped up and kept going."

Management might well consider these comparisons between the treatment of old men and old machines, very carefully. Those of us who were close to production problems during the World War recall many instances of men well over fifty who were the backbone of the shops. This was particularly true in shops where the machine equipment was not of the best. The average "old hand" can coddle a machine that might be a total loss to a young man of less experience.

"THE FINEST WE HAVE EVER USED"



- ★ Smooth Acceleration and Deceleration
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- ★ Smaller Size, Lower Cost

WIDESPREAD praise endorses the New Oilgear *Fluid Power* Variable Speed Transmission. Production men say its performance amazes them. It provides hairline accuracy of speed control; steplessly variable speed; even, positive speeds; smooth acceleration and reverse; a complete range of automatic and hand operation. The new simplified design makes Oilgear compact, widely adaptable and low in price. You will want full information about the transmission that is upsetting production figures in many lines. Bulletin 60000 sent free. THE OILGEAR COMPANY, 1309 W. Bruce St., Milwaukee, Wisc.

OILGEAR

Fluid Power

VARIABLE SPEED TRANSMISSIONS

Railroads Use Metal Spray

METAL spraying is finding a field in the railroad backshop. One progressive shop is spraying Monel metal on all water pump piston rods. On other worn parts such as stoker crankshafts, armature journals, lathe spindles and the like, they put on a coating of high carbon steel. Sprayed metal is usually best finished by grinding. Some ascribe the advantage of this method to the peening action of the grinding wheel. Parts sprayed with hard metal and properly finished have a long wear life and give satisfaction in most cases.

Exit Oil Can

LOCOMOTIVE engineers and oil cans have been inseparable since steam railroading began. Oiling up on each side of the locomotive has long been a ritual that must not be neglected. The new Mallets of the Norfolk & Western have broken the tradition. The engineer still has the oil can but no place to use it.

All bearings that take oil are supplied by a pump from a central reservoir on the side of the locomotive. Oil supply to each bearing is metered by the usual control of the opening at the bearing. Roller bearings also have a place on the axles of these new locomotives which exemplify the progressive management of the road. A glance at the earnings of the N.&W. indicate that progress pays.

LUFKIN

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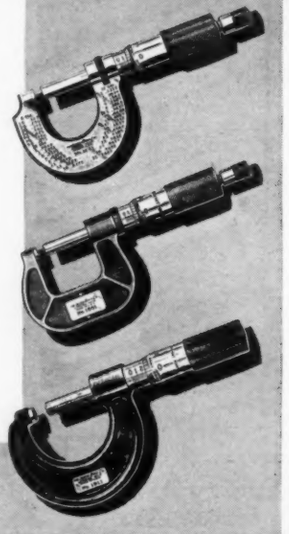

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SAGINAW, MICHIGAN, U. S. A.

Canadian Factory WINDSOR, ONT.

England-to-Canada Air Service May Be Started

THE Irish Transatlantic Corporation, Ltd., is in communication with the British Government with regard to a projected air service to Canada, according to *Industrial Britain*. If the necessary assurances are forthcoming, it is hoped to put the service into operation some time this year.

The terminus in England of the proposed service is to be Liverpool's municipal airport at Speke. The service would be from Liverpool via Londonderry—which would serve as a refueling base—to Sydney, Nova Scotia.

Technical experts have inspected the Speke airport and pronounced favorably upon it.

Coronation Boom

A PART at least of the increased activity in British metal-working may be traced directly to the coming coronation. One firm is planning to manufacture several million special medals at the rate of 250,000 a week to commemorate the occasion. According to *Industrial Britain*, this firm paid 200 guineas to secure a satisfactory design.

Another fertile field is decorations for motor cars. Radiator attachments and shields for bumpers are among the favorite items.

Oil

LACK of a little oil has cost thousands of dollars in many shops. Lubricating systems have been greatly improved, but none of them can be efficient unless there is oil in the reservoir. Finding a way to be dead sure no one forgets is a real

problem. One shop put large, glass reservoirs on top of every machine so the foreman could see them at a glance. But he forgot to "glance" one day and the boss found about half of them empty. Perhaps this is a chance to borrow the "low-water alarm" idea from our boiler room friends.

Rack for Sling Chains

SHOPS handling a variety of work require a variety of sling chains. Unless these slings are kept where they can be readily found much time is lost in getting the right chain, not to mention the nuisance of having them in the way, frequently as a menace to passersby.

The Chambersburg Engineering Co. solved the problem by welding up a rack of suitable sections as shown herewith. The rack has its own base

or lower frame so that it can be moved to any other place should it seem advisable. For although it is now on a slightly raised foundation this could be easily duplicated elsewhere and the rack placed in its new location.

With a rack of this kind every sling chain is in plain sight and is out of the way. The sling desired can be readily lifted off the rack by the crane, and also replaced with but little assistance from the floor. If necessary, material can be stored inside the rack.

Johnson Wants a Pre-Trade School

JOHN R. GODFREY

OLD MAN JOHNSON has been away from the shop quite a bit lately, which has given him time to think along lines not directly connected with the business. He was all pepped up on trade training and apprenticeship the other day when I saw him. And as usual, he has some ideas that seem to be worth passing along.

"There's a lot of new angles to handling young folks, more than there used to be, Godfrey. When we were young we boys started in the shop at fifteen—the girls went into the mills—or stayed home waiting for a meal ticket to come along. This sixteen-year old school limit puts a crimp in that, not to mention the difficulty of finding a job.

"I'm not kicking about the new sixteen-year old schooling law, Godfrey. It's probably a good thing. But we've got to adjust other things to it. Not all boys and girls can absorb another two or three years of academic teaching—book learning to you. I was fed up even before I quit at fourteen. It's all right for those who can take it and have it of some use after they get it. But I'm egotistical enough to think the average can't absorb any more than I did. And if they could, what will they do with it?

"Take our own town here, Godfrey, as an example. What jobs will be open to the new crop, even if we all have good business? There's our

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There is a special edition for each of the ten Ryerson plants. The book featuring the stocks of our plant nearest you will be mailed shortly. If you do not receive it in a few days, please let us hear from you.

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shop and a couple of others in similar lines. Then there are some textiles, some leather work, the baby carriage shop and the celluloid plant. They must either fit into those, or be grocery clerks, soda water jerkers, or sell socks and such, unless they go into garage work or other service industries. If none of these suit, or there's no jobs for them, they've got to leave town.

"Seems to me this makes a new job for the schools. It's up to the educator to find ways of teaching those who never will be scholars, things that will help them when they go to work, after they are sixteen. Of course, we have trade schools that try to give them a start at being machinists, or carpenters, or such. Some of them do a darn good job, too. We've had some of their boys in the shop, and they make good machinists in less time than a green boy we take in and train. But that's only part of the story.

"What we need, Godfrey, is a sort of pre-trade school—one that doesn't try to make machinists or plumbers—but that gives the boys some fundamental knowledge that will help even if he sells socks or plays with a fizz pump in drug stores. It isn't an easy job to lay out such a course, and my own notions are a bit hazy—but I believe it can be done. There's a lot of mechanical things that come into every line of work. Sort of a horse-sense attitude toward a lot of things. You've seen men put a big wrench on a ½-in. nut and wonder why the bolt broke.

"It's up to our educators to give as much useful information as possible to those who are waiting for their sixteenth birthday and a job. It should be things that will help them in any kind of a job the town offers. Some of it may be in a sort of shop—some of it playing store or visiting some industry. Moving pictures can do much to arouse interest and give a lot of general information. Pictures of this kind might easily help a boy or girl decide on what kind of a job they'd like. And that of itself is sometimes quite a problem.

"I'm all for the later ages in starting to work, Godfrey. But it means we've got to change our school plans to fit the new conditions. It's no easy job and I haven't any full blown plan to offer. But we better be thinking about it in earnest and not let things slide waiting for a Santa Claus to do it for us."

Keep your tools sharp the easy, speedy, dependable way with LeBlond Universal, *consistently accurate*, precision Grinders, that will grind any face on any shape cutter, faster, better, more economically, and get tools back in production without delay.

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"Stepped" Dimensions for Jig Boring

In Mr. Hinman's third article in the current series, and published in this case under the above title (*AM*—Vol. 81, page 167) the following errors appeared:

On page 168 the value of C in the eighth line from the bottom, first column, should read: C = cot of angle 42 deg., 30 min. Also on the same page, second column, fourteen lines from the top, the expression for cot D should read:

$$\text{Cot } D = \cot \frac{(E + 90^\circ)}{2}.$$

In Fig. 17, page 169, the arrowheads indicating angles K should have been drawn to the heavy dotted line instead of to the vertical center line.

In the first line, third column, page 169, angle E corresponds to the tangent found by dividing A by C, not A by B, and angle D likewise corresponds with the tangent found by dividing A by B.

Die-Castings Used for Automotive Parts

C. R. MAXON
New Jersey Zinc Company

THAT die-castings possess exceptional utility for a wide range of automotive parts is too well recognized to require emphasis. Among the chief reasons for their extensive use are:

1. Adaptability to rapid production at moderate cost and within closer dimensional limits, not only as compared to other castings, but also as against stampings and forgings.

2. Adaptability to a wide range of shapes and sizes, including complex parts with difficult core work.

3. Producibility, in some instances, with surfaces so smooth as to require little or no polishing or even buffing prior to plating.

4. Producibility in remarkably thin sections, yet with a stiffness not attained, as a rule, with stamped parts, and often with the metal disposed (as in bosses and ribs) in a manner not feasible in stamping and forging.

5. Relative ease of machining, when machining is required, with a minimum waste in metal removed.

6. Comparative resistance to corrosion under most conditions of service, such corrosion as does occur being confined to the surface and rarely affecting the strength or serviceability.

Zinc alloys account for over 95 per cent of automotive die castings and hence are considered almost exclusively here. Besides the low cost of these alloys, factors in their favor include: (a) generally excellent physical properties; (b) low die cost, because the metal casts at low temperature and dies do not require heat-treatment. Limitations of zinc alloys include those involving temperature in service. Prolonged use at temperatures above 300 F. are not recommended. Impact strength is high under normal temperatures, but decreases rapidly at very low temperatures, although the impact strength is regained with return to normal temperatures. Alloys made to standard specifications are entirely free from the destructive intergranular corrosion which was encountered with die-castings in which good alloying practice was not followed.

Although grilles may be regarded as a somewhat special form of die-casting, they are prominent because of their position on the car. They are die-cast, in fact, largely because it is important, from a sales standpoint, to have a grille of fine appearance.

Some grilles are lighter this year than last and others could be made lighter than they are by (a) greater forethought in design, (b) using the grille as a supported rather than as a supporting unit, (c) making the grille of smaller size and/or with larger openings, and (d) using a design which permits of thinner sections.

Die-cast hubs for steering wheels, especially the de luxe type with wire spokes, are extensively used and are an excellent example of an application which is largely structural in character. These hubs vary in weight from about 1.3 lb. to about 6.5 lb., a difference which would seem to indicate that some hubs are heavier than they need be for purely structural reasons. It is quite common practice to use a steel insert to which spokes are welded and it might result in some weight saving if the insert were extended to include the keyway, where stresses may be highest.

Ford light-switches, which surround the horn button, are being die-cast this year, whereas a year ago they

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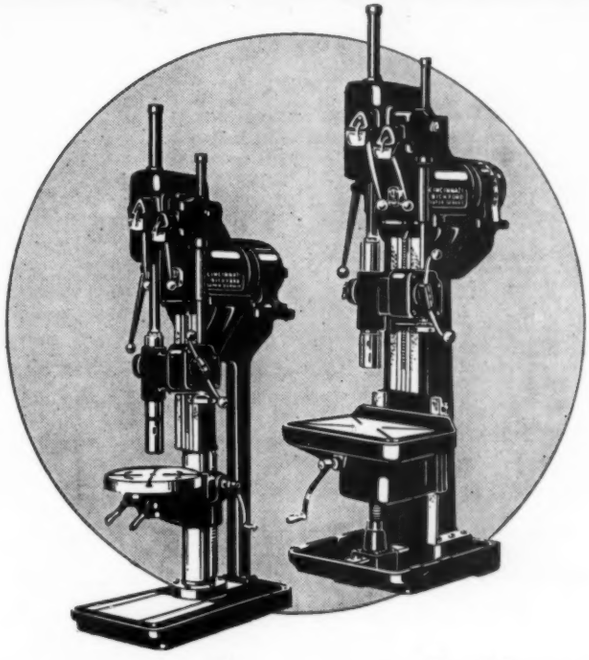

more holes per dollar!

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Cincinnati Bickford invites the most searching comparison of these modern machines with other drilling machines. We are confident your analysis will convince you that Super Service Uprights offer maximum return in production per dollar of investment. The Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio, U. S. A.

CINCINNATI BICKFORD

were molded from plastic with a die-cast insert. This change is understood to have represented some cost saving and also to have avoided certain difficulties in color matching encountered with the plastic. A Macoid finish to match other interior parts is now applied. Castings are made in a two-cavity die running 400 to 450 shots an hour, and giving a very smooth surface.

As against this, another steering wheel hub is cast in a two-cavity die at about 100 shots an hour, the slower rate being a result of using a steel insert which has to be forced over a core pin (to prevent zinc from coating the inner surface). A special loading fixture for the inserts is needed and has to be lowered between the die halves between shots and the die partly closed to force the rings over the core pin. Cleaning of the hub is done in a press with a shaving die.

Another example of structural use of die-castings is in the frames for D-shaped ventilating wings and quarter windows. Such parts have the required supporting bosses for pivots and limit stops and can be made quite light, though perhaps a little heavier than formed steel frames. Important advantages are the closer dimensions which can be held and the freedom from rusting which the use of a zinc alloy secures. When a rubber cover is desired for sealing purposes, the die casting can be brass plated and used as an insert in the mold forming the rubber cover, which is vulcanized to the casting.

It is entirely feasible today to die-cast either straight or curved moldings of almost any length up to 50 in., or more, in a great variety of surprisingly thin sectional shapes, but with convenient fastening bosses such as are not readily provided in stamped or rolled moldings. In some cases, these moldings can even be made flexible enough to conform to variations in stamped parts. An example of this is the D-shaped moldings, a pair of which are used to outline the grille on current Dodge models. These moldings have a section thickness of about $\frac{1}{32}$ in. and are about 9/16 in. wide. Over-all dimensions of the D-shaped casting are approximately 30x8 in. and represent about 60 linear inches of molding with bosses spaced about 5 in. apart. Casting is done at the rate of about three shots a minute and with so little flash that cleaning is a very simple and rapid process. The molding is quite flexible.

Methods of Fastening

In fastening die-castings to sheet-metal parts, several alternative types of fastenings deserve consideration. They include: tapped holes in die-cast bosses; cored or drilled holes in die-cast bosses for self-threading studs or screws; studs die-cast in place; riveting with separate tubular or solid rivets, or fastening with through screws or bolts; riveting or spinning over of projections forming a part of the casting; use of so-called "speed nuts" on integral projections of the casting provided for the purpose; use of hooked projections on the casting with a spring clip or other fastening for engaging one or more hooks; and various combinations of these types.

When it comes to body hardware, exterior as well as interior, die-cast parts are practically without competition and give universal satisfaction. Again the matter of appearance and freedom in design, as well as the remarkably smooth finish which is attained today are all in favor of the die-casting. Now that a satisfactory

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bright nickel finish has been developed, it is also possible today, nearly if not entirely, to do away with polishing, buffing and coloring operations for most grades of hardware. Much experimental work has been done, both here and abroad, in the coating of hardware parts produced by die-casting with cellulose acetate applied by the injection molding process. It permits of extremely attractive finishes, which give promise of good enduring qualities, but it remains to be seen whether it can compete with plating in cost.

Abstracted from an address delivered by C. R. Maxon before the Detroit Section of the Society of Automotive Engineers, March 1, 1937. Copies may be obtained from New Jersey Zinc Co., 160 Front St., New York City.

NEW BOOKS

CATALOG PRACTICE AND PROCEDURE—*Report prepared by Technical Publicity Association, Inc., the New York chapter of N.I.A.A. 16 pages 8½ x 11 in., unillustrated, does not contain advertising. Published by National Industrial Advertisers Association, Inc., 100 East Ohio St., Chicago, Ill. Price: $2.00, free to members of N.I.A.A.*

The committee has organized a large amount of the available data on the subject and has enumerated the many sides of the question in an impartial manner. The basic fundamentals regarding catalogs have been reduced to easily understood statements, thus preparing the way for further study and investigation along individual lines.

This work includes definitions, outlines distribution procedure, enumerates catalog uses, and shows a sample questionnaire which may be used by those who wish to obtain information from their customers and prospects in order to determine their own catalog procedure.

•

PHYSICAL TESTING OF METALS—*By H. D. Churchill, associate professor of mechanics, Case School of Applied Science. 109 pages, 6 x 8⅞ in. Cloth board binding. Indexed and illustrated. Published by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio. Price $2.00.*

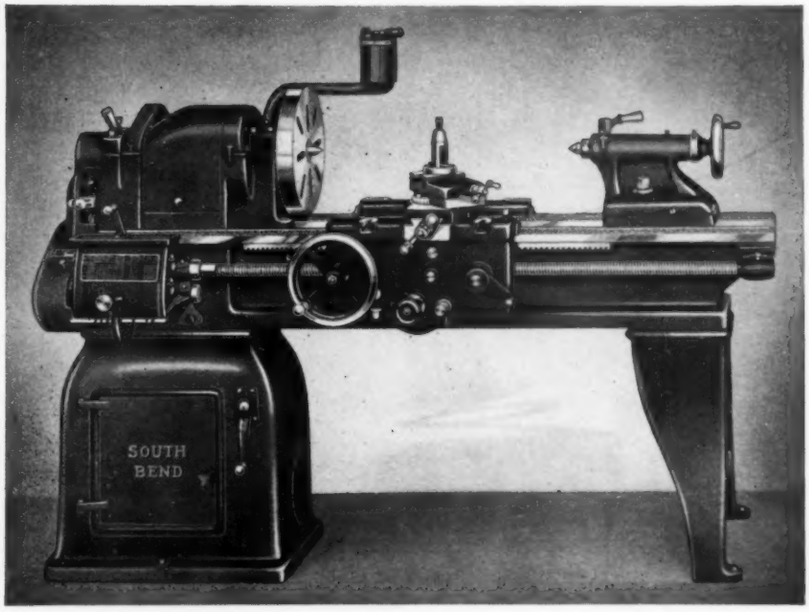
Those who attended the National Metal Congress in Cleveland last October had the opportunity of hearing Professor Churchill's series of lectures on the physical testing of metals. These lectures have been published to make their subject matter available in permanent form.

The author divides his discussion into five major groups corresponding to the divisions made in his lecture course. These cover tension and compression, shear and bending, hardness and impact, fatigue, and special tests. The main discussions are preceded by a historical sketch and followed by a bibliography.

Aside from incorporating in a compact volume the procedure for testing metals, Professor Churchill's treatment includes some very helpful discussions of the interpretation of test results.

•

HOW TO WELD 29 METALS.—*First edition. By Charles H. Jennings, engineer in charge of welding research, Westinghouse Electric & Mfg. Company, 100 pages, 5¼ x 8¼*



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South Bend, Indiana, U. S. A.

SOUTH BEND *Precision* LATHES
MODERN LATHES FOR MODERN INDUSTRY

in., illustrated; does not contain advertising. Published by Westinghouse Electric & Mfg. Company, Department 5-N, East Pittsburgh, Pa. Price: 50 cents.

A comprehensive discussion of the procedure, conditions and materials for welding modern alloys. Specific data was given for welding all types of joints with varying thickness of metal; includes information on electrode diameter, welding current, speeds, deposition, and other factors. This book should be of much value to welding operators in simplifying and improving the welding of present-day metals and alloys.

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MATERIALS HANDBOOK.—*Third Edition, by George S. Brady, technical adviser to "Coordinator for Industrial Cooperation," formerly managing editor of "Product Engineering" and "American Machinist". 663 pages, 4 x 6¾ in., not illustrated. Published by McGraw-Hill Book Company Inc., 330 West 42nd St., New York. Price $5.*

Exacting demand of modern manufacturing for the use of correct material to meet varying needs of each separate product make it necessary that everyone who might be called upon to choose a material for a given job have a comprehensive knowledge of the materials available for use in his field. This handbook has been published to fill the need of a concise encyclopedia that would give distinguishing data on raw materials in a convenient form.

In this third edition the items relating to engineering construction materials have been rewritten to include enough comparative data on physical properties to enable the designing engineer and the architect to judge the relative merits of the particular material for the requirement in hand. Patented and trade-names of materials have in many cases been grouped in their respective classifications in order to give a broader picture of particular subjects. New materials have also been added.

A 26-page appendix tabulates frequently used data of interest to both the engineer and the purchasing agent.

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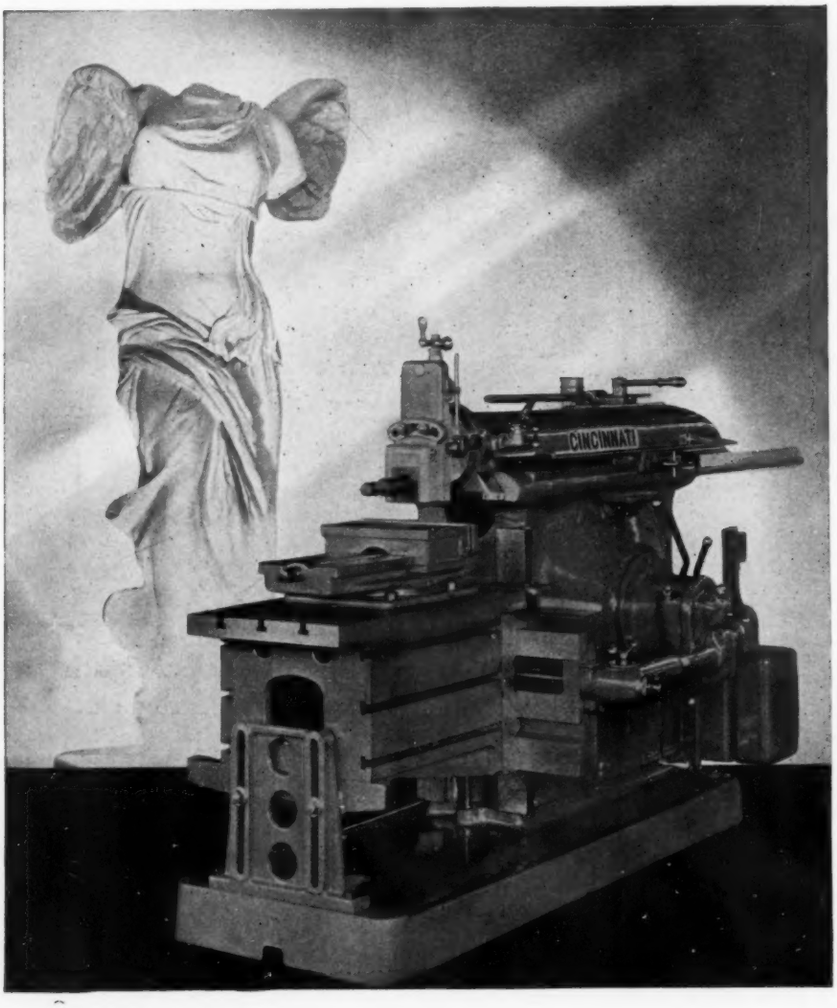
ART AND THE MACHINE—*By Sheldon Cheney and Martha Candler Cheney. 307 pages, 7x9 in. Numerous illustrations. Clothboard covers. Published by Whittlesey House, McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. Price, $3.75.*

Principles of utility, economics and art have been merged and blended by present-day industrial designers. A new concept and method of procedure is making itself manifest. It has changed the appearance of a great variety of common machine-made articles which perform all sorts of services; it is commonly known as modern design.

The authors present in this volume an interesting non-technical discussion of the beginning of the art-expresion movement, purposes, evolution of trends, and effect on contemporary mass production of goods. Many illustrations are used showing the effect of the artist's technique on merchandise, appliances, machinery and architecture.

While intended for the general reader, the book contains much that is thought-provoking and inspiring to designers and industrialists.



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CUSTOM HOUSE GUIDE—*Seventy-fifth Annual Edition. Published by Custom House Guide, Box 7, Sta. P., Custom House, New York, N. Y. Price: $15.*

The new guide has been revised to include new rates of duty established under the fifteen reciprocal trade agreements which have been concluded by the United States with foreign nations. The alphabetical index of 30,000 commodities has been entirely revised. Opposite each commodity are the new rates of duty provided. Included in this alphabetical index are a large number of commodities which do not appear in the Tariff Act of 1930.

The Customs Regulations, which have been changed considerably during the past year, appear completely revised to date and include all Treasury Decisions, and other changes which have been enacted since these regulations were originally issued.

Other information includes port sections which completely covers the activities and facilities of all principal ports. A section of general information includes: foreign forwarding agents, weights, measures, coin values, trade terms, air services, Federal Alcohol Administration, Department of Agriculture, State Department, Department of Commerce, Bureau of Foreign and Domestic Commerce, Consular Service, Foreign Customs Headquarters and Embassies.

Subscribers also receive as a monthly supplement the American Import and Export Bulletin, in which are contained all important revisions and materials contained in the Custom House Guide throughout the year, and coverage of the latest rules, decisions, regulations, new laws and trade agreements affecting foreign trade.

TRADE PUBLICATIONS

BELLOWS. A four-page folder, describing standard types of bellows and typical bellows assemblies, is being mailed by the Bridgeport Thermostat Co., Inc., Bridgeport, Conn.

COPPER ALLOY BULLETIN. A new monthly bulletin, reporting news and technical developments of copper and copper-base alloys, is announced by the Bridgeport Brass Co., Bridgeport, Conn. The "Copper Alloy Bulletin" made its appearance with the March issue.

FLOW METERS. The Brown Instrument Co., Wayne & Roberts Ave., Philadelphia, has published Catalog No. 2004 covering the complete line of indicating, recording and integrating flow meters. Operation and construction of these meters is described.

GEAR CHUCKS. Garrison gear chucks, adapted for use with precision diamond boring machines, are described in a folder offered by Garrison Machine Works, Inc., Dayton, Ohio.

GRINDING CHART. Carboloy Co., Inc., 2989 E. Jefferson Ave., Detroit, Mich., announces publication of an 18x12 in. wall chart, No. GC-71, which presents, in condensed form, the most efficient methods for grinding single-point Carboloy tools. It also contains recommendations on grinding wheels, diamond wheels, diamond lapping disks, wheel speeds, rough and finish grinding procedure, and methods for hogging off stock rapidly.

HYDRAULIC PRESSES. Bulletin No. 40, issued by Hannifin Mfg. Co., 621-

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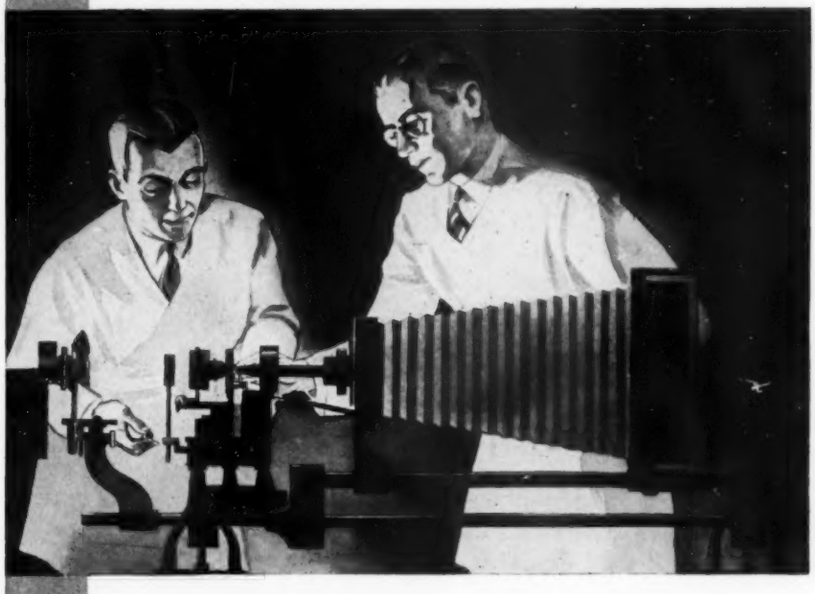


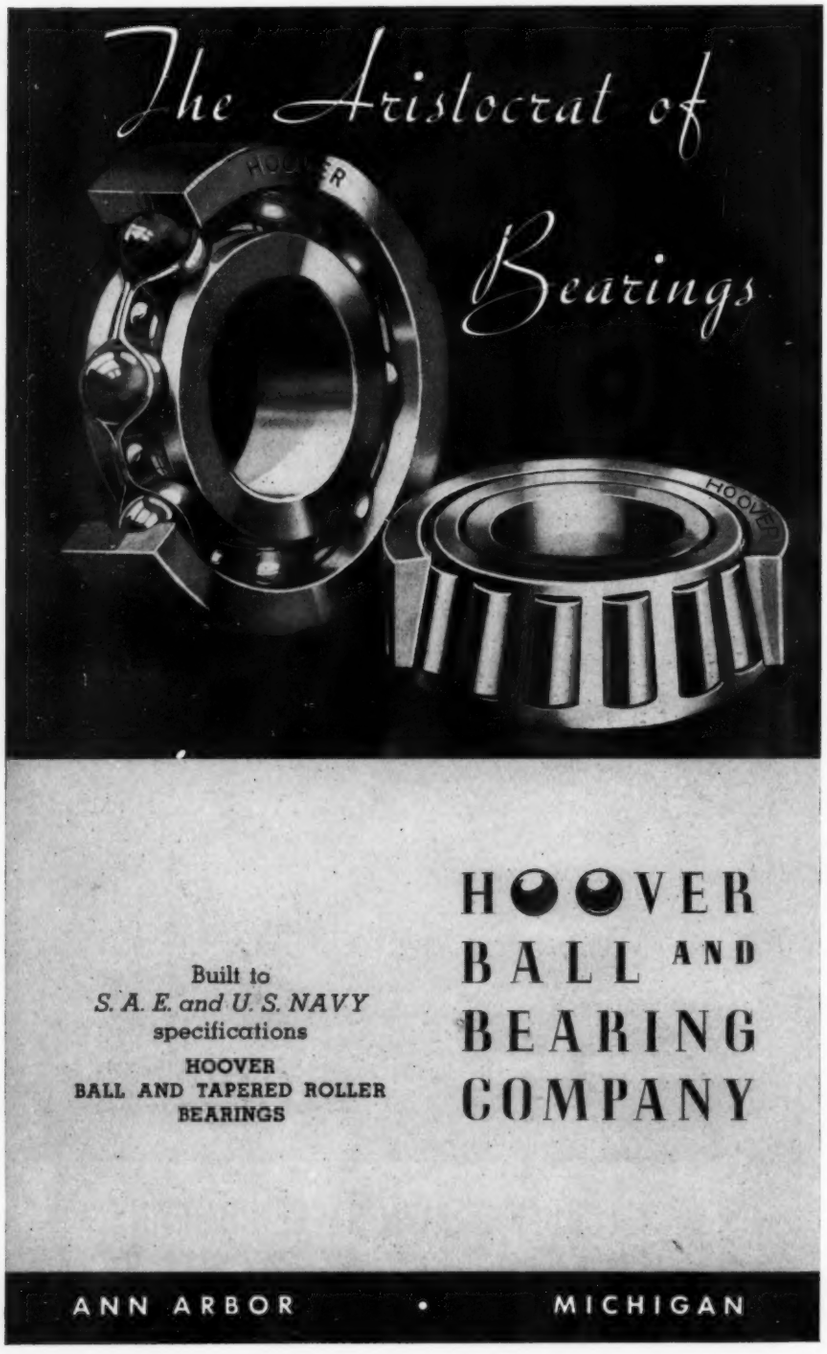
WYCKOFF DRAWN STEEL COMPANY
General Offices: First National Bank Bldg., Pittsburgh, Pa.
Mills at Ambridge, Pa. and Chicago, Ill.
Manufacturers of Carbon and Alloy Steels
Turned and Polished Shafting, Turned and Ground Shafting
Wide Flats up to 12"x2"

631 South Kolmar Ave., Chicago, lists and describes standard and special types of hydraulic presses for manufacturing operations.

INSULATING MATERIALS. Catalog Section 65-040, published by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., lists the characteristics, applications and list prices for treated papers, fabrics and tapes.

LINESTARTERS. Leaflet L 20568-A, issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., lists and describes the applications, sizes, construction and control circuits for the Class 11-220 line of midget contactors and linestarters.

NEOPRENE. A 6-page bulletin recently issued by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., discusses the discovery, commercial development and significance of "Neoprene" to science and industry. The booklet is written in nontechnical language, and is scientifically accurate.



ROLLER BEARINGS. Hyatt Bearings Div., General Motors Corp., P. O. Box 476, Newark, N. J., is mailing a folder in which is discussed the precision with which Hyatt roller bearings are manufactured.

ROTATING CAM SWITCHES. A line of rotating-cam switches, designed especially for built-in control applications, is described in Bulletin GEA-2230 offered by General Electric Co., Schenectady, N. Y. These switches are manufactured in a number of electrical and mechanical modifications, making the line universally adaptable to applications varying from machine-tool motor control to steel-mill master switching.

SHIELDED ARC ELECTRODES. Page "Hi-Tensile F Electrodes" are described in Booklet No. DH-984, published by the Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa. This booklet describes the electrode in detail and discusses the shielded arc method of welding.

SPRINGS. The Barnes-Gibson-Raymond Div., Associated Spring Corp., 6400 Miller Ave., Detroit, Mich., has announced publication of an 88-page book: "The Art and Science of Spring Making." This book is a complete, semi-technical discussion of spring making in all its forms, subject matter is clearly indexed and conveniently grouped for reference.

STEEL COLOR CODE. The proposed Simplified Practice Recommendation for a Color Code for Marking Steel Bars has received the required degree of acceptance by the industry and is to be promulgated as of April 1, 1937, according to an announcement by the Division of Simplified Practice, National Bureau of Standards. The recommendation will be identified as Simplified Practice Recommendation R166-37. Complimentary mimeographed copies may be obtained until printed copies are available.

THERMOMETERS AND HYDROMETERS. Catalog No. 1100A, offered by C. J. Tagliabue Mfg. Co., Park & Nostrand Aves, Brooklyn, N. Y., lists and describes the TAG line of laboratory thermometers and hydrometers.

WIRE ROPE. Safe Practices Pamphlet No. 26, published by National Safety Council, Inc., 20 North Wacker Drive, Chicago, discusses proper care of wire rope and cable used for hauling, hoisting and power transmission. This pamphlet is based on the accident-prevention experience of a number of employers. Price: 25 cents per copy.